CITY OF SEATTLE

ORDINANCE 127108

COUNCIL BILL 120832

AN ORDINANCE relating to Seattle's construction codes; adopting the Seattle Boiler Code, Building Code, Electrical Code, Energy Code, Existing Building Code, Fuel Gas Code, Mechanical Code, Plumbing Code, and Residential Code and chapters of the Washington Administrative Code by reference, amending certain chapters of those codes, and adopting new chapters for those codes; amending Sections 3.06.030, 5.73.020, 11.60.690, 22.101.010, and 22.502.016 of the Seattle Municipal Code; and repealing Section 1 of Ordinance 126278, Ordinance 126279, Ordinance 126358, and Ordinance 126508.

WHEREAS, The City of Seattle seeks to balance housing affordability with the benefits of reduced greenhouse gas emissions and increased energy efficiency when updating the Seattle Energy Code; NOW, THEREFORE,

BE IT ORDAINED BY THE CITY OF SEATTLE AS FOLLOWS:

ADOPTION OF NEW CONSTRUCTION CODES

Section 1. To the extent listed in Sections 22.101.010 and 22.502.016 of the Seattle Municipal Code as amended by this ordinance, and with copies filed with the City Clerk as noted in those sections, the following codes are adopted by reference:

A. The 2024 Seattle Boiler and Pressure Vessel Code, substantially as shown in Attachment A to this ordinance.

B. The 2021 International Building Code, with amendments as shown in Attachment B to this ordinance.

C. The 2023 National Electrical Code, with amendments as shown in Attachment C to this ordinance.

D. Chapters 51-11C and 51-11R of the Washington Administrative Code (WAC), the 2021 Washington State Energy Code, with amendments as shown in Attachment D of this ordinance.

E. The 2021 International Existing Building Code, with amendments as shown in Attachment E to this ordinance.

F. The 2021 International Fuel Gas Code, with amendments as shown in Attachment F to this ordinance.

G. The 2021 International Mechanical Code, with amendments as shown in Attachment G to this ordinance.

H. Chapter 51-56 WAC, adopting the 2021 Uniform Plumbing Code, with amendments as shown in Attachment H to this ordinance.

G. The 2021 International Residential Code, with amendments as shown in Attachment I to this ordinance.

Section 2. Section 22.101.010 of the Seattle Municipal Code, last amended by Ordinance 126279, is amended as follows:

22.101.010 List of construction codes

Table A for 22.101.010 lists various adopted Seattle editions of construction codes. For each base code that has been adopted by reference, a copy is available in the City Clerk's Office under the listed Clerk File number. Each code consists of the listed portions of the base code, any additional chapters listed as adopted by ordinance, and amendments adopted by ordinance.

Table A for 22.101.010
Construction codes adopted by reference

Name	Base code	Additional chapters	Clerk File
Seattle Boiler and Pressure Vessel Code	Attachment A to ((~~Ordinance 126278~~)) this ordinance		

Name	Base code	Additional chapters	Clerk File
Seattle Building Code	((~~2018~~)) 2021 International Building Code, Chapters 2 through 29 and 31 through 35	Chapters 1 and 30, in Attachment B to ((~~Ordinance 126278~~)) this ordinance	((~~321854~~)) 323091
Seattle Electrical Code	((~~2020~~)) 2023 National Electrical Code and selected portions of chapter 296-46B WAC	Article 80, in Attachment C to ((~~Ordinance 126278~~)) this ordinance	((~~321855~~)) 323099
Seattle Energy Code	((~~2018~~)) 2021 Washington State Energy Code		((~~321861~~)) 323092
Seattle Existing Building Code	((~~2018~~)) 2021 International Existing Building Code, Chapters 2 through 11, 13, 15, and 16 and Appendix A	Chapter 1, in Attachment ((~~D~~)) E to ((~~Ordinance 126278~~)) this ordinance	((~~321856~~)) 323093
Seattle Fuel Gas Code	((~~2018~~)) 2021 International Fuel Gas Code, Chapters 2 through 8 and Appendices A through D	Chapter 1, in Attachment ((~~E~~)) F to ((~~Ordinance 126278~~)) this ordinance	((~~321857~~)) 323095
Seattle Mechanical Code	((~~2018~~)) 2021 International Mechanical Code, Chapters 2 through 9 and 11 through 15 and Appendices A and B	Chapter 1, in Attachment ((~~F~~)) G to ((~~Ordinance 126278~~)) this ordinance	((~~321858~~)) 323096
Seattle Residential Code	((~~2018~~)) 2021 International Residential Code, Chapters 2 through 10, 12 through 24, 29, and 44 and Appendices AF, AQ, and AT	Chapters 1 and 44, in Attachment ((~~G~~)) I to ((~~Ordinance 126278~~)) this ordinance	((~~321860~~)) 323097

Section 3. Section 22.502.016 of the Seattle Municipal Code, last amended by Ordinance 126278, is amended as follows:

22.502.016 Adoption of Seattle Plumbing Code

The Seattle Plumbing Code consists of: (1) all of chapter 51-56 of the Washington Administrative Code (WAC) in effect on ((~~July 1, 2020~~)) March 15, 2024, except Sections 51-56-008 and 51-56-0100; (2) amendments and additions to chapter 51-56 WAC adopted by the City Council by ordinance; and (3) Chapter 1, which is composed of all local provisions. One copy of chapter 51-56 ((~~of the Washington Administrative Code~~)) WAC in effect on ((~~July 1, 2020~~)) March 15, 2024, is filed with the City Clerk in Clerk File ((~~321859~~)) 323098.

REPEAL OF OLD CONSTRUCTION CODES AND TRANSITION PROVISIONS

Section 4. Section 1 of Ordinance 126278 and Ordinances 126279, 126358, and 126508, adopting or amending various construction codes, are repealed.

Section 5. Beginning on the effective date of this ordinance and ending on November 15, 2024, permit applicants who submit a valid and fully complete building permit application during that period may elect to have the application reviewed under the provisions of codes repealed by this ordinance rather than the provisions of codes adopted in this ordinance.

SEATTLE MUNICIPAL CODE CLEANUP AND CORRECTIONS

Section 6. Section 3.06.030 of the Seattle Municipal Code, last amended by Ordinance 124919, is amended as follows:

3.06.030 Director—Powers and duties

The Director of the Seattle Department of Construction and Inspections, under direction of the Mayor, shall manage the Seattle Department of Construction and Inspections, appoint, assign, and dismiss all employees in conformance with the City's personnel ordinances and rules, and perform the following functions:

A. Enforcing development-related ordinances and rules of the City; ((~~, including but not limited to the Building Code; the Residential Code; the Electrical Code; the Mechanical Code; the Housing and Building Maintenance Code; the Land Use Code; the Pioneer Square Minimum Maintenance Ordinance; the Condominium Conversion Ordinance; the Energy Code; the Stormwater Code; the Grading Code; the Rental Registration and Inspection Ordinance; the Tenant Relocation Assistance Ordinance; the Noise Control Code; the Shoreline Master Program; and the Regulations for Environmentally Critical Areas;~~))

* * *

Section 7. Section 5.73.020 of the Seattle Municipal Code, last amended by Ordinance 126443, is amended as follows:

5.73.020 Definitions

* * *

"Bedroom" means a sleeping area in a dwelling unit that meets the following criteria: (1) requirements for a habitable space, as defined by Chapter 2 of the Seattle Building Code; (2) minimum room widths and ceiling heights according to ((~~Section 1207.1 and Section 1207.2~~)) Sections 1208.1 and 1208.2 of the Seattle Building Code; (3) natural light requirements according to Section 1204.2 of the Seattle Building Code; (4) natural ventilation requirements according to Section 1202.5 of the Seattle Building Code; and (5) complete separation of the habitable space from other portions of the dwelling unit by walls and one or more exit access doorways, consistent with Chapter 2 of the Seattle Building Code.

* * *

Section 8. Section 11.60.690 of the Seattle Municipal Code, enacted by Ordinance 108200, is amended as follows:

11.60.690 Transportation of liquefied petroleum gas ((~~.~~))

The bulk transportation of liquefied petroleum gas (LPG) is prohibited in or through Fire Zone No. 1 as defined in the ((~~City of Seattle Building Code (see~~)) Fire Zone One map ((~~)~~)) below.

* * *

SEVERABILITY AND EFFECTIVE DATE CLAUSES

Section 9. The provisions of this ordinance are declared to be separate and severable. The invalidity of any clause, sentence, paragraph, subdivision, section, or portion of this ordinance, or the invalidity of its application to any person or circumstance, does not affect the validity of

the remainder of this ordinance or the validity of its application to other persons or circumstances.

Section 10. When considering additional code requirements that depart from the Washington State Energy Code, the Executive shall develop a process that includes a cost-effectiveness analysis, using the same methodology as the State, informed by input from a new task force that includes, but is not limited to, non-profit and market rate housing developers.

Section 11. Section 4 of this ordinance shall take effect on November 15, 2024.

Section 12. This ordinance shall take effect as provided by Seattle Municipal Code Sections 1.04.020 and 1.04.070.

Passed by the City Council the 8th day of October, 2024, and signed by me in open session in authentication of its passage this 8th day of October, 2024.

President _____ of the City Council

☑ Approved / ☐ returned unsigned / ☐ vetoed this 11th day of October, 2024.

Bruce A. Harrell, Mayor

Filed by me this 11th day of October, 2024.

Scheereen Dedman, City Clerk

(Seal)

Attachments:
Attachment A – 2024 Seattle Boiler and Pressure Vessel Code
Attachment B – Amendments to 2021 International Building Code
Attachment C – Amendments to 2023 National Electrical Code
Attachment D – Amendments to 2021 Washington State Energy Code
Attachment E – Amendments to 2021 International Existing Building Code
Attachment F – Amendments to 2021 International Fuel Gas Code
Attachment G – Amendments to 2021 International Mechanical Code
Attachment H – Amendments to Chapter 51-56 WAC
Attachment I – Amendments to 2021 International Residential Code

2024 Seattle Boiler and Pressure Vessel Code

Section 1 – Administrative

1.1 Title.

These regulations shall be known as the "Seattle Boiler and Pressure Vessel Code," may be cited as such, and will be referred to herein as "this code."

1.2 Purpose.

The purpose of this code is to provide minimum standards for the protection of public health, safety, and property by regulating and controlling the quality, location, and installation of boilers and pressure vessels, piping, and appurtenances. It is not intended to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

1.3 General.

1.3.1 Scope.

This code applies to the construction, erection, installation, operation, inspection, repair, alteration, relocation, replacement, addition to, use, or maintenance of all boilers and pressure vessels. The design and testing of equipment regulated by this code are subject to the approval of the code official.

1.3.2 Applicability of city laws.

A boiler permit application shall be considered under the Seattle Boiler Code in effect on a date as provided below, or on a date as otherwise required by law.

A. Boiler code permit applications shall be considered under the codes in effect on the date used to determine the codes applicable to the building permit application in accordance with the Seattle Building Code Section 101.3 if any of Items 1 through 3 apply:
   1. The boiler permit application is submitted as part of a building permit application;
   2. The boiler permit application is for work directly associated with a building permit but is submitted separately from the building permit application; or
   3. The boiler permit application is for initial tenant alterations submitted no later than 18 months after the date of the approved final inspection for the building, and is submitted before the expiration date of the building permit for the tenant alteration, as determined by Seattle Building Code Section 106.9.

B. Boiler permit applications, other than those subject to subsection 1.3.2.A, shall be considered under the codes in effect on the date a complete boiler permit application is submitted that complies with all the requirements of subsection 4.1 of this code, Permits Required.

1.3.3 Conflicts.

Where, in any specific case, different sections of this code specify different materials, methods of construction, or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

1.3.4 Workmanship.

All equipment, appurtenances, devices, and piping shall be installed in a workmanlike manner, in accordance with recognized engineering practice, and in conformity with the provisions and intent of this code.

1.4 Organization and duties of the code official

1.4.1 General.

A. Applications and permits. The code official shall: receive applications, review construction documents, and issue permits for the erection and alteration, demolition, and moving of buildings and structures; inspect the premises for which such permits have been issued; and enforce compliance with provisions of this code.

B. Inspections. The code official shall make the required inspections or the code official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The code official is authorized to engage such expert opinion as the code official deems necessary to report upon unusual technical issues that arise.

C. Notices and orders. The code official shall issue necessary notices or orders to ensure compliance with this code.

D. Official records. The code official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for retention of public records.

1.4.2 Right of entry.

With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the code official may enter a building or premises at any reasonable time to perform the duties imposed or authorized by the code.

1.4.3 Liability.

Nothing in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City or its officers, employees, or agents for any injury or damage resulting from: 1) the failure of equipment to conform to the provisions of this code; 2) any inspection, notice, order, certificate, permission, or approval authorized or issued; 3) the implementation or enforcement of this code; or 4) any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees, or agents. This code shall not be construed to relieve or lessen the responsibility of any person owning, operating, or controlling any equipment, building, or structure for any damages to persons or property caused by defects, nor shall the Seattle Department of Construction and Inspections or The City of Seattle be held to have assumed any such liability by reason of the inspections, permits, or certificates issued under this code.

1.4.4 Responsibility for Compliance.

Compliance with the requirements of this code is the obligation of the owner of the building, structure, or premises, the duly authorized agent of the owner, or any other person responsible for the condition or work, not the obligation of the City or any of its officers, employees, or agents.

1.4.5 Cooperation of other officials and officers.

The code official may request, and shall receive, so far as is required in the discharge of the code official's duties, the assistance and cooperation of other officials of The City of Seattle.

1.4.6 Rules of the code official. The code official has authority to interpret this code and adopt and enforce rules and regulations supplemental to this code as may be necessary to clarify the application of this code. Such interpretations, rules, and regulations shall conform to the intent and purpose of this code. The code official shall promulgate, adopt, and issue rules in accordance with the procedures specified in SMC Chapter 3.02, the Administrative Code.

1.5 Construction Codes Advisory Board.

1.5.1 General. A committee of the Construction Codes Advisory Board may examine proposed administrative rules and amendments relating to this code and related provisions of other codes and make recommendations to the code official and to the City Council for changes in this code. The committee will be called as needed by the Construction Codes Advisory Board.

1.6 Violations, enforcement, and penalties.

1.6.1 Violations. It is a violation of this code for anyone to perform the actions contained in subsection 1.6.1 below.

A. Work in violation of code. Install, erect, construct, enlarge, alter, repair, replace, remodel, move, improve, remove, convert, demolish, equip, occupy, use, or maintain any boiler or pressure vessel or auxiliary equipment or cause, allow, or direct the same to be done in the City, contrary to, or in violation of, any provision of this code.

B. Unapproved material or devices. Use any material or install any device, appliance, or equipment that does not comply with this code or has not been approved by the code official.

C. Operating without a license. Have charge of, operate, or permit any person to have charge of or operate any boiler or steam engine regulated by this code without a license to do so as required by the Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420.

D. Posted notices. Remove, mutilate, destroy, or conceal any notice or order issued or posted by the code official pursuant to the provisions of this code, or any notice or order issued or posted by the code official in response to a natural disaster or other emergency.

E. Requesting inspections. Conduct work under a permit without requesting an inspection required by this code.

F. Encouraging violation of code. Knowingly aid, abet, counsel, encourage, hire, induce, or otherwise procure another to violate or fail to comply with this code.

G. Non-compliance with notice of violation. Fail to comply with a notice of violation by the date set by the code official in the notice.

H. Complying with orders of the code official. Fail to comply with any order issued by the code official, including but not limited to a stop work order, emergency order, or hazard correction order.

1.6.2 Notice of Violation. If, after investigation, the code official determines that standards or requirements of this code have been violated, or that orders or requirements have not been complied with, the code official may issue a notice of violation to the owner, agent, or other person responsible for the action or condition.

A. Contents of notice of violation. The notice of violation shall state:

1. The standards or requirements violated;
2. What corrective action, if any, is necessary to comply; and
3. A reasonable date certain for compliance.

B. Serving notice of violation. The notice shall be served upon the owner, agent, or other responsible person by personal service or regular first class mail, addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice shall be posted in a conspicuous place on the premises. The notice may also be posted on the premises at any time.

C. Code official review. Any person affected by a notice of violation issued pursuant to this subsection 1.6.2 may obtain a review of the notice by making a request in writing to the code official within 10 business days after service of the notice.

D. Review procedure. The review shall occur not earlier than 10 nor later than 20 days after the request is received by the code official unless otherwise agreed to by the person requesting the review. Any person affected by the notice of violation may submit additional information to the code official. The review shall be made by a representative of the code official who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and perform a site visit.

E. Decision. After the review, the code official shall render one of the following four decisions:

1. Sustain the notice of violation;
2. Withdraw the notice of violation;
3. Amend the notice of violation; or
4. Continue the review of the notice of violation to a date certain.

F. Order. The code official shall issue an order containing the decision within 15 days after the review is completed and shall cause the order to be sent by regular first-class mail to the person or persons requesting the review, to any person on whom the stop work order was served, and to any other person who requested a copy before issuance of the order, addressed to their last known address.

G. Scope of enforcement. Nothing in this subsection 1.6.2 limits or precludes any action or proceeding to enforce this code, and nothing in this subsection obligates or requires the code official to issue a notice of violation prior to the imposition of civil or criminal penalties.

1.6.3 Stop work orders.

The code official may issue a stop work order whenever any work is being done without a permit, contrary to the provisions of this code, contrary to a permit issued by the code official, or in the event of dangerous or unsafe conditions related to equipment, construction, or demolition of boilers or pressure vessels.

A. Violation identified. The stop work order shall identify the violation or unsafe condition and may prohibit work or other activity on the site.

B. Serving the stop work order. The code official shall serve the stop work order by posting it on the premises in a conspicuous place at the site. If posting is not physically possible, the stop work order may be served by personal service or by regular first-class mail to the last known address of the person doing or causing the work to be done, the property owner, or the holder of a permit if the

work is being stopped on a permit. For purposes of this subsection 1.6.3.B, service is complete at the time of posting or personal service or, if mailed, three business days after the date of mailing.

C. Stop work order effective date. Stop work orders are effective when posted, or if posting is not physically possible, when one of the persons identified in subsection 1.6.3.B is served.

D. Work after stop work order. It is unlawful for any person to engage in work or to cause work to continue until authorization from the code official is received.

E. Administrative review of stop work orders. Any person aggrieved by a stop work order may obtain a review of the order by delivering to the code official a written request for review within two business days of the date of service of the stop work order.

1. **Review procedure.** The review shall occur within two business days after receipt by the code official of the request for review unless otherwise agreed by the person making the request. Any person affected by the stop work order may submit additional information to the code official for consideration as part of the review at any time prior to the review. The review will be made by the code official, who will review all additional information received and may also request a site visit.
2. **Decision.** After the review, the code official may:
    a. Sustain the stop work order;
    b. Withdraw the stop work order;
    c. Modify the stop work order; or
    d. Continue the review to a date certain.
3. **Issuing order.** The code official shall issue an order containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first-class mail to the person or persons requesting the review, any person on whom the stop work order was served, and any other person who requested a copy before issuance of the order, addressed to their last known address.

1.6.4 Authority to disconnect utilities in emergencies.

The code official has the authority to:

A. Disconnect fuel-gas utility service or energy supplied to a building, structure, premises, or equipment regulated by this code in cases of emergency when necessary to eliminate an immediate hazard to life or property; and

B. Enter any building or premises to disconnect utility service. Whenever reasonably feasible, the code official shall notify the serving utility, owner, and occupant of the building, structure, or premises of the decision to disconnect prior to taking such action, and shall notify the serving utility, owner, and occupant of the building, structure, or premises in writing of such disconnection immediately after the disconnection.

1.6.5 Reconnection.

Until the code official authorizes reconnection of equipment, it is a violation of this code to:

1. Make connections from an energy, fuel, or power supply or supply energy or fuel to any equipment regulated by this code that is disconnected or ordered to be disconnected by the code official; or

2. Use the equipment ordered to be disconnected before the code official authorizes the reconnection and use of such equipment.

1.6.6 Authority to condemn equipment. Whenever the code official determines that any equipment or portion thereof regulated by this code is hazardous to life, health, or property, the code official shall order in writing that such equipment be disconnected, removed, or restored to a safe or sanitary condition. The written notice shall fix a date certain for compliance with such order. It is a violation of this code for any person to use or maintain defective equipment after receiving such notice. When any equipment or installation is to be disconnected, the code official shall give written notice of such disconnection and causes therefor within 24 hours to the serving utility, the owner, and the occupant of the building, structure, or premises. When any equipment is maintained in violation of this code, or in violation of a notice issued pursuant to the provisions of this subsection 1.6.6, the code official shall institute any appropriate action to prevent, restrain, correct, or abate the violation.

1.6.7 Emergency order. Whenever the code official finds that any equipment regulated by this code is so unsafe as to constitute an imminent hazard to life or limb, the code official may issue an emergency order. The emergency order may:

A. Content of emergency order. The emergency order may:

1. Direct that the equipment be restored to a safe condition by a date certain;
2. Require that the building, structure, or premises, or portion thereof, containing the equipment be vacated within a reasonable time to be specified in the order, or in the case of extreme danger, the order may specify immediate vacation of the building, structure, or premises, or portion thereof; or
3. Authorize immediate disconnection of the utilities or energy source.

B. Service of emergency order. The emergency order shall be posted on the premises or personally served on the owner of the building or premises or any person responsible for the condition. The order shall specify the time for compliance.

C. Effect of emergency order. No person may occupy a building, structure, or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure, or premises, or portion thereof, is restored to a safe condition as required by the order and this code. It is a violation of this code for any person to fail to comply with an emergency order issued by the code official. When any equipment is operated in violation of this code, or in violation of an order issued pursuant to the provisions of this subsection 1.6.7, the code official may begin an action to prevent, restrain, correct, or abate the violation.

1.6.8 Hazard correction order. Whenever the code official finds that unsafe equipment exists, the code official may issue a hazard correction order.

A. Content of hazard correction order. The order shall:

1. State the conditions causing the equipment to be unsafe;
2. Direct the owner or other persons responsible for the unsafe equipment to correct the condition; and
3. Give a date certain for completing the required corrections.

B. Alternative to hazard correction. In lieu of correction, the owner may submit a report or analysis of the conditions to the code official establishing that the equipment is, in fact, safe. The code official may require that the report or analysis be prepared by a licensed engineer. The code official may accept the report as adequate or may reject the report as insufficient.

C. Service of hazard correction order. The order shall be served upon the owner, agent, or other responsible person by personal service or regular first-class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted on the premises if it is also being served by personal service or first-class mail.

D. Effect of hazard correction order. It is a violation of this code for any person to fail to comply with a hazard correction order as specified in this subsection 1.6.8.

1.6.9 Recording.

The code official may record a copy of any order or notice with the King County Department of Executive Services.

1.6.10 Civil penalties.

A. Civil penalties. Any person violating this code is subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved. In cases where the code official has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

B. Enforcement in Municipal Court. Civil actions to enforce this code shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation of this code exists or existed. The issuance of a notice of violation or of an order following review by the code official is not itself evidence that a violation of this code exists.

C. Judicial review. Because civil actions to enforce this code must be brought exclusively in Seattle Municipal Court pursuant to subsection 1.6.10.B, orders of the code official, including notices of violation issued under this chapter, are not subject to judicial review pursuant to chapter 36.70C Revised Code of Washington (RCW), Judicial Review of Land Use Decisions.

D. Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by this code may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

1.6.11 Alternative criminal penalty.

Anyone who violates or fails to comply with any notice of violation or order issued by the code official pursuant to this code or who removes, mutilates, destroys, or conceals a notice or order issued or posted by the code official shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than 364 days, or by both fines and imprisonment for each separate violation. If the violation continues to exist, each day the violation or failure to comply is continued shall constitute a separate offense.

1. **Additional Relief.** The code official may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

2. **Administrative review by the code official.** Prior to issuance of the boiler or pressure vessel permit, applicants may request administrative review by the code official of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the code official.
3. **Construction Codes Advisory Board Review.** After completion of an administrative review by the code official, and prior to issuance of the boiler or pressure vessel permit, applicants may request a review of the code official's decisions or actions pertaining to the application and interpretation of this code by the Construction Codes Advisory Board (CCAB). The review will be performed by three or more members of the CCAB, chosen by the board chair. The chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the CCAB committee is advisory only. The final decision is made by the code official.

Exception: Stop work orders, notices of violations and revocations of permits shall not be subject of a CCAB review.

1.7 Existing Installations.

1.7.1 Existing boilers and pressure vessels.

Boilers and pressure vessels lawfully in existence at the time of the adoption of this code may continue in use at the location approved in the original permit. The systems may be maintained or repaired, converted to another type of fuel, or have components replaced if the use, maintenance, repair, conversion of fuel, or component replacement is done in accordance with the original code of construction and/or installation requirements when approved by the code official.

1.7.2 Maintenance of existing installations.

All boilers and pressure vessels, materials and appurtenances, and parts, both existing and new, shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices or safeguards required by the Seattle Boiler and Pressure Vessel Code shall be maintained in conformance with the code edition in effect when the system was installed, and boilers and pressure vessels shall be maintained in accordance with the manufacturer's instructions or nationally recognized standards. The owner or the owner's designated agent is responsible for maintenance of boilers and pressure vessels and auxiliary equipment. To determine compliance with this subsection 1.7.2, the code official may require a boiler or pressure vessel or equipment to be inspected or re-inspected.

Exception: The code official may modify the requirements of this subsection 1.7.2 where all or a portion of the building is unoccupied.

1.7.3 Changes in existing building or occupancy.

Existing boilers and pressure vessels that are a part of a building or structure housing a vessel undergoing a change in use or occupancy, as defined in the Seattle Building Code, shall comply with all requirements of this code that are applicable to the new use or occupancy. If the use of the boiler or pressure vessel changes, a new permit may be required and the equipment shall comply with this code.

1.7.4 Landmarks.

The code official may modify this code as it applies to landmarks and require in lieu thereof alternate requirements that, in the opinion of the code official, will result in a reasonable degree of safety to the public and the occupants of those buildings.

1.8 Alternative materials, designs, and methods of construction.

This code does not prevent the use of any material, alternative design, or method of construction not specifically allowed or prohibited by this code, provided the alternative is approved and its use is authorized by the code official. The code official may approve an alternative if it complies with the intent of this code and, when considered together with other safety features of the building or other relevant circumstances, provides at least an equivalent level of strength, effectiveness, fire resistance, durability, sanitation, and safety. The code official may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternative. Acceptance of a Construction Code Advisory Board recommendation may be considered sufficient evidence by the code official to approve the alternative. The code official may, but is not required to, record the approval of alternatives and any relevant information in the files of the code official or on the approved permit plans.

1.9 Modifications.

The code official may modify the requirements of this code for individual cases provided:

1. There are practical difficulties in complying with the requirements of this code;
2. The modification is in conformity with the intent and purpose of this code; and
3. The modification provides a reasonable level of strength, effectiveness, fire resistance, durability, sanitation, and safety when considered together with other safety features of the building or other relevant circumstances. The code official may, but is not required to, record the approval of modifications and any relevant information in the files of the code official or on the approved set of construction documents.

1.10 Tests.

If there is insufficient evidence of compliance with the requirements of this code, or evidence that a material or method does not conform to the requirements of this code, the code official may require that tests, as proof of compliance, be made at no expense to the City. Test methods shall be those specified in this code or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternative or modification, the code official shall determine the test procedures. All tests shall be made by an agency approved by the code official. The agency shall provide a report of tests or examination results, and those results shall be retained by the code official for the period required for retention of public records.

Section 2 – Definitions

2.1 Scope.

The following words and terms shall, for the purposes of this code, have the meanings given in this Section 2.

2.2 Interchangeability.

Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

2.3 Terms defined in other codes.

Terms used but not defined in this code but defined in the International Building Code, International Fire Code, Seattle Electrical Code, International Fuel Gas Code, Uniform Plumbing Code, or ASME Standard CSD-1 Controls and Safety Devices for Automatically Fired Boilers shall be used. When a definition is found here and in ASME CSD-1, the definition given in this code shall govern.

2.4 Terms not defined.

When a definition is not found below, the definitions of terms found in the codes and standards listed in subsection 3.1 of this code shall govern.

"A" OCCUPANCIES are places of public assembly. Details can be found in Seattle Building Code Chapter 3.

ACCESSIBLE means having access to and includes the removal of an access panel, door, or similar obstruction designed for removal.

ACCESSIBLE, READILY means capable of being reached safely and quickly for operation, repair, or inspection without climbing over or removing obstacles, or resorting to the use of portable access equipment.

ALTERATION means a change in the item described on the original Manufacturer's Data Report which affects the pressure-containing capability of the pressure-retaining item.

APPLIANCE means a device utilizing fuel or other forms of energy to produce light, heat, power, refrigeration, or air conditioning, including vented decorative appliances.

APPROVED means accepted by the code official.

APPROVED AGENCY means an agency approved by the code official that is regularly engaged in conducting tests or examinations or furnishing inspection services.

ASME means American Society of Mechanical Engineers.

ATTENDANT means the person in charge of the operation of a boiler or unfired pressure vessel.

AUTOMATIC CERTIFICATION PERMIT means a permit used to modify the licensed attendance requirements for a specific boiler. (See Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420.)

"B" OCCUPANCIES are business uses, such as offices. Details can be found in Seattle Building Code Chapter 3.

BOILER means a closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the direct application of heat, including fired units for heating or vaporizing liquids other than water where these systems are complete within themselves.

BOILER ROOM means any room primarily used to house a boiler.

BOILER, CERTIFIED AS AUTOMATIC means a boiler that complies with subsection 4.25 of this code, has an automatic certification permit that passed final inspection and is used to modify the licensed attendant requirements for a specific boiler. (See the Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420).

BOILER, CERTIFIED AS MONITORED means a boiler that complies with subsection 4.26 of this code and is used to modify the licensed attendant requirements for a specific boiler. (See the Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420.)

BOILER, HOT-WATER SUPPLY means a listed potable water boiler, exceeding the limitations of a potable water heater, but that does not exceed a pressure of 160 psig (1,100 kPa) or a temperature of 250 degrees F (121 degrees C), that provides hot water to be used externally to itself.

BOILER, LOW-PRESSURE HOT-WATER-HEATING means a boiler that circulates hot water for heating purposes at pressures not exceeding 160 psig (1,100 kPa) and at temperatures not exceeding 250 degrees F (121 degrees C), which water is then typically returned to the boiler.

BOILER, LOW-PRESSURE STEAM-HEATING means a boiler furnishing steam for heating purposes at pressures not exceeding 15 psig (103 kPa).

BOILER, POWER HOT-WATER (HIGH-TEMPERATURE WATER BOILER) means a boiler used for heating water or liquid to a pressure exceeding 160 psig (1,100 kPa) or to a temperature exceeding 250 degrees F (121 degrees C).

BOILER, POWER means a boiler that generates steam or vapor at pressures exceeding 15 psig (103 kPa).

BOILER, RENTAL means any type of boiler that is owned by an entity for the purpose of renting to other entities for temporary or long-term usage.

BOILER, USED means any installed boiler that was in previous service.

BURNER means a device that conveys fuel and air or steam into the combustion chamber of a boiler to cause and maintain stable combustion.

BUSINESS DAY means a day that is neither a Saturday, a Sunday, nor a City holiday recognized in SMC 4.20.190.

CHIMNEY means a primarily vertical structure containing one or more flues for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

CODE OFFICIAL is the Director of the Seattle Department of Construction and Inspections and the Director's designees, which include the Chief Boiler Inspector and other authorized representatives.

COMBUSTION AIR means the air necessary for complete combustion of a fuel, including theoretical air and excess air.

DAY, when not a business day, means a calendar day. When any period of time prescribed by this code is expressed in days and the period ends on a day that is not a business day, the period shall extend to the next business day.

DEPARTMENT means the Seattle Department of Construction and Inspections.

DRAFT HOOD means a nonadjustable device built into an appliance or made a part of the vent connector from an appliance, that is designed to:

1. Provide for the ready escape of the flue gases in the event of no draft, backdraft, or stoppage beyond the draft hood;
2. Prevent a backdraft from entering the appliance; and
3. Neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

DUCT means a tube or conduit for conveying air. The air passages of listed self-contained systems are not to be construed as air ducts.

"E" OCCUPANCIES are educational facilities. Details can be found in Seattle Building Code Chapter 3.

EXTERNAL INSPECTION means an inspection of the outside and fireside of the boiler, including safety controls.

"F" OCCUPANCIES are factory and industrial uses. Details can be found in Seattle Building Code Chapter 3.

FUEL TRAIN means a series of valves, regulators, and controls, between the burner and the source of fuel, that regulates and controls the flow of fuel to the burner.

"H" OCCUPANCIES are high hazard uses. Details can be found in Seattle Building Code Chapter 3.

"I" OCCUPANCIES are medical and institutional facilities. Details can be found in Seattle Building Code Chapter 3.

INSPECTOR means any of the inspector types defined by this code, who examine internal and external boiler and pressure vessel parts and surfaces and who test the function of operating controls and safety devices for correct operation.

INSPECTOR, CITY means an inspector employed by the Department.

INSPECTOR, INSURANCE means an inspector employed by an authorized insurance company.

INSURANCE COMPANY, AUTHORIZED means an insurance company that has been authorized by the State of Washington to write and provide insurance coverage for loss of boilers or unfired pressure vessels.

INTERNAL INSPECTION means an inspection requiring that the water side of the boiler be examined visually.

JACKETED STEAM KETTLE means a pressure vessel, with inner and outer walls, that is subject to steam pressure and is used to boil or heat liquids or to cook food.

LETHAL SUBSTANCE means a poisonous gas or liquid that in a very small amount is dangerous to life when inhaled or absorbed through the skin or membranes. It is the responsibility of the user or the user's designated agent to determine and declare if contents are lethal substances.

LANDMARK means a building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

LICENSED OPERATOR means a person licensed to operate boilers in accordance with the Seattle Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420.

LISTED means that equipment, materials, products, or services are included in a list published by an organization acceptable to the code official. The listing organization provides an evaluation of products or services by performing periodic inspection during production of equipment or materials, or periodic evaluation of services. The resulting listing states either that the equipment, material, product, or service meets identified standards, or was tested and found suitable for use in a specified manner.

"M" OCCUPANCIES are retail and wholesale facilities. Details can be found in Seattle Building Code Chapter 3.

MANUALLY OPERATED (FIRED) BOILER means a boiler that requires constant attendance by an operator with no duties other than the proper and safe operation of the boiler and its related equipment when the boiler is in operation.

MAWP means maximum allowable working pressure.

NATIONAL BOARD means the National Board of Boiler and Pressure Vessel Inspectors.

NBIC means National Board Inspection Code.

PERSON means an individual, receiver, administrator, executor, assignee, trustee in bankruptcy, trust, estate, firm, partnership, joint venture, club, company, joint stock company, business trust, municipal corporation, political subdivision of the State of Washington, corporation, limited liability company, association, society, or any group of individuals acting as a unit, whether mutual, cooperative, fraternal, nonprofit, or otherwise, and the United States or any instrumentality thereof.

PILOT means a small burner that is used to light the main burner.

PILOT, CONTINUOUS (also known as constant burning pilot) means a pilot that burns without turndown during the entire time the boiler is in service, whether the main burner is firing or not.

PILOT, INTERMITTENT means a pilot that is automatically lighted each time there is a call for heat and burns during the entire period the main burner is firing.

PILOT, INTERRUPTED means a pilot that is automatically lighted each time there is a call for heat. The pilot fuel is cut off automatically once the main burner flame is ignited.

PRESSURE VESSEL means a closed, unfired container under internal pressure.

PRESSURE VESSEL, USED means any installed pressure vessel that was in service at a previous time.

PURGE means to blow air, fuel, water, or other foreign substances out of a container or confined space.

"R" OCCUPANCIES are residential facilities. Details can be found in Seattle Building Code Chapter 3.

REPAIR means the work necessary to restore pressure-retaining items to a safe and satisfactory operating condition.

REPAIR INSPECTOR means a person holding a valid A or IS Commission with an "R" Endorsement issued by the National Board who performs the final inspection of a repair or alteration.

REPAIR ORGANIZATION means an organization in possession of a valid National Board "R" Certificate of Authorization issued by the National Board.

"S" OCCUPANCIES are storage facilities. Details can be found in Seattle Building Code Chapter 3.

SMC means the Seattle Municipal Code.

"U" OCCUPANCIES are accessory utility facilities such as private garages and greenhouses. Details can be found in Seattle Building Code Chapter 3.

VENT means a pipe or other conduit composed of factory-made components, containing a passageway for conveying combustion products and air to the atmosphere, listed and labeled for use with a specific type or class of appliance.

VENT CONNECTOR means the pipe that connects an approved fuel-fired appliance to a vent.

WATER HEATER, COMBINATION means a potable water heater: the heat source for which may be fired, electric, thermal, solar, or indirect; that is listed for the use of producing both space heat and potable hot water; and that does not exceed 210 degrees F (99 degrees C), maximum allowable working pressure (MAWP) of 160 psig (1103 kPa), volume of 120 gallons (454 L), or a heat input of 200,000 Btu/hr (58.6 kW). Appliances and equipment that exceed any one of these values are classified as boilers.

WATER HEATER, POOL means a potable water heater that is listed for use of heating water for pools, spas, saunas, and similar equipment and that does not exceed 210 degrees F (99 degrees C), maximum allowable working pressure of 160 psig (1103 kPa), volume of 120 gallons (454 L), or a heat input of 200,000 Btu/hr (58.6 kW). Appliances and equipment that exceed any one of these values are classified as boilers.

WATER HEATER, POTABLE. Any listed heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system excluding any appliance or equipment that exceeds any of the following:

1. An operating temperature of 210 degrees F (99 degrees C);
2. A maximum allowable working pressure of 160 pounds per square inch (1103 kPa);
3. A volume of 120 gallons (454 L); or
4. A heat input of 200,000 Btu/hr (58.6 kW).

Any *appliance* or equipment that exceeds any one of these values is classified as a *boiler*.

Section 3 – Applicable Installation Codes, Listings, and Standards

3.1 Required codes.

Boilers and pressure vessels installed within The City of Seattle shall conform to this code and the minimum manufacturing standards, including any addenda, in effect on the date of manufacture as listed in subsection 3.1.1 of this code. Where differences occur between the requirements of this code and the codes and standards referenced in subsections 3.1.1.A through 3.1.1.E, the provisions of this code apply.

3.1.1 Applicable codes and standards.

A. ASME Boiler and Pressure Vessel Code, Sections I, III, IV, VIII, X, and PVHO-1 (construction codes).

B. The American National Standards Institute (ANSI) B31.1.0 Power Piping Code.

C. Boilers with burner fuel input ratings of less than 12,500,000 Btu/hour shall comply with the fuel train requirements set forth in ASME CSD-1. Boilers with burner fuel input ratings of 12,500,000 Btu/hour or more shall comply with the fuel train requirements set forth in National Fire Protection Association (NFPA) 85.

D. Appurtenances that are not within the scope of the ASME construction codes listed in subsection 3.1.1.A may be constructed to a nationally recognized standard of construction approved by the code official.

E. Jacketed steam kettle vessels that are equal to or greater than 1-1/2 cubic feet in volume (11.22 gallons capacity) shall bear an appropriate ASME certification mark.

3.2 Listing.

Appurtenances, such as safety controls, operating controls, burner assemblies, and fuel trains, shall bear the mark of a recognized listing agency or the appropriate certifications as listed by the manufacturer. Appurtenances shall be installed and operated in accordance with the requirements of the listing or the manufacturer's certification and written instructions. Electrical components and wiring shall bear the mark of a recognized listing agency and have a listing appropriate for the environment of the installation.

3.3 Certification mark and registration.

Boilers and pressure vessels shall bear the appropriate certification mark required by the ASME Boiler and Pressure Vessel Code, and shall be registered with the National Board.

Exception: Cast iron and cast aluminum sectional boilers, and pressure vessels bearing the ASME "UM" designator, do not require registration with the National Board.

Section 4 – Installation

4.1 Permits required.

Except as otherwise specifically provided in this code, the installer shall obtain a boiler/pressure vessel permit from the code official prior to commencement of any of the following work:

1. Installation or replacement of new or used boilers and pressure vessels.
2. Installation of rental boilers.
3. Certification of boilers as Automatic.
4. Certification of boilers as Monitored.
5. Modification of existing control systems on boilers certified as Automatic or Monitored.
6. Replacement or modification of fuel burners, changing of fuels, or addition of different fuel combinations.
7. Repair or alteration of boilers or pressure vessels.
8. Installation of pressure vessels containing lethal substances, regardless of size or occupancy.

9. Potable water heaters and pool heaters that exceed any of the following limits, which are classified as boilers:
    a. 200,000 BTU/Hr input;
    b. 120 gallons capacity;
    c. 160 psig; or
    d. 210 degrees F.

Informational Note: Seattle Energy Code Section C403.1.4 restricts the use of electric resistance and fossil fuel-fired equipment for HVAC heating in most buildings, and Section C404.2.1 restricts the use of electric resistance and fossil fuel-fired service water heating equipment in Group R-1 and R-2 buildings.

4.2 Exemption from permits. Providing they do not contain lethal substances, the following boilers, pressure vessels, and other equipment do not require a boiler/pressure vessel permit from the code official:

1. Portable unfired pressure vessels that are inspected by the State of Washington as required by chapter 70.79 RCW;
2. Containers for liquefied petroleum gases regulated by the Seattle Fire Code;
3. Any boiler or pressure vessel subject to regular inspection by federal inspectors or licensed by a federal authority, such as the Department of Transportation (DOT);
4. Pressure vessels located in Groups B, F, H, M, R, S, and U Occupancies having a volume of 5 cubic feet or less and operated at pressures not exceeding 250 psig;

Informational Note: Expansion tanks exempted for size by subsection 4.2.4 of this code, shall conform to the requirements of ASME Section IV, HG-709 or HLW-809 applicable edition together with applicable addenda.

5. Unfired pressure vessels, regardless of occupancy, that are:
    a. less than 1-1/2 cubic feet in volume (11.22 gallons), or
    b. 6 inches in internal diameter with no limit as to length or pressure;
6. Water storage tanks with no air cushion and no energy or heat source that operate at ambient temperature;
7. Unfired pressure vessels of any size that are protected by approved pressure relief devices set to operate at a pressure not exceeding 15 psig or otherwise open to ambient atmospheric pressure;
8. Boilers and pressure vessels under the direct ownership and operation of the State of Washington that are inspected in accordance with Washington State boiler and pressure vessel rules (chapter 70.79 RCW) and have a current Washington State certificate to operate; and
9. Potable water heaters and pool heaters that do not exceed any of the following limits:
    a. 200,000 BTU/Hr input;
    b. 120 gallons capacity;
    c. 160 psig; or
    d. 210 degrees F.

Informational Note: Potable water heaters require a plumbing permit issued from Public Health – Seattle and King County.

4.3 Application for permit.

To obtain a permit, the installer shall first file an application in a format determined by the code official.

A. Every application shall:

1. Identify and describe the work to be covered by the permit for which application is made;
2. Describe the land on which the proposed work is to be done by legal description, property address, or similar description that will readily identify and definitively locate the proposed building or work;
3. Be accompanied by construction documents and/or specifications in the standard ASME form (Manufacturers' Data Report) when required by the code official;
4. Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority;
5. Include the names, addresses, and phone numbers of the boiler owner, general contractor, and any other contractor or contact persons; and
6. Provide additional data and information, including but not limited to the manufacturer name and serial number, as may be required by the code official.

B. The code official may require that one or more sets of construction documents, including plans, computations, and specifications, be prepared and submitted to the code official. Construction documents shall be submitted to the code official or designee at the time of the first boiler inspection. Nothing shall prevent the code official from requiring the submittal of construction documents prior to the issuance of the permit. Plans and specifications shall be drawn to a clearly indicated and commonly accepted scale in a format determined by the code official. The construction documents shall be sufficiently clear for electronic storage and shall show that the proposed installation conforms to the provisions of this code and all applicable laws, ordinances, rules, regulations, and orders.

4.4 Reserved.

4.5 Emergency repairs.

In the case of emergency, the installation or repair of any boiler or pressure vessel or auxiliary equipment may be made without first applying for a permit. The code official shall be given notice by email or voicemail of the work performed within the later of 24 hours or one business day from the time when the emergency work was started. Permit applications shall be submitted within the later of 24 hours or one business day from the start of the emergency work, or as directed by the code official.

4.6 Application review and permit issuance.

The application shall be reviewed by the code official or designee. The application may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

4.6.1 Issuance of permit.

The code official shall issue a permit to the applicant if the code official finds the following:

1. The work described in the application, and other construction documents when required by the code official prior to issuance, substantially conforms to the requirements of this code and other pertinent laws and ordinances;
2. The permit fees specified in the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees, have been paid; and
3. The applicant has complied with all requirements to be performed prior to issuance of a permit for the work: under other pertinent laws, ordinances, or regulations; included in a master use permit; or otherwise imposed by the code official. When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

4.6.2 Compliance with approved construction documents. When the code official issues a permit, the code official shall endorse the permit in writing or in electronic format and, where plans have been required, stamp the plans "APPROVED." Such approved plans and permit shall not be changed, modified, or altered without authorization from the code official, and all work shall be done in accordance with the approved construction documents and permit except as authorized by the code official during a field inspection to correct errors or omissions, or as authorized by subsection 4.6.3 of this code.

4.6.3 Revisions to the permit. When changes to the approved work are made during construction, approval of the code official shall be obtained prior to execution. The boiler and pressure vessel inspector may approve minor changes for work not reducing the structural strength or fire and life safety of the structure or the integrity of the boiler or pressure vessel or auxiliary equipment. The inspector shall determine if it is necessary to revise the approved construction documents. If revised plans are required, changes shall be submitted to and approved by the code official, accompanied by fees specified in the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees, prior to occupancy. All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits. Minor changes shall not incur additional fees if these changes do not: (1) add to the general scope of work; (2) change the basic design concept; (3) involve major relocation of equipment, ducts, or pipes; (4) substantially alter approved equipment size; or (5) require extensive re-review of the plans and specifications.

4.6.4 Cancellation of permit applications. Applications may be cancelled if no permit is issued by the earlier of the following: (1) 12 months following the date of application; or (2) 60 days after the date of written notice that the permit is ready to be issued. After cancellation, construction documents may be returned to the applicant or destroyed by the code official. The code official shall notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

4.7 Validity of permit. The issuance or granting of a permit or approval of construction documents shall:

1. Not be construed to be a permit for, or an approval of, any violation of any provisions of this code or any other pertinent laws and ordinances;
2. Not prevent the code official from requiring correction of conditions found to be in violation of this code or other pertinent laws and ordinances of the City;

3. Not prevent the code official from requiring the correction of errors in the construction documents or from preventing building operations being carried on thereunder when in violation of this code or of other pertinent laws and ordinances of the City; and
4. Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the code official or other administrative authority requiring the correction of any such conditions.

4.8 Permit Expiration. Authority to do the work authorized by a permit expires 18 months from the date of issuance. An approved renewal extends the life of a permit for an additional 18 months from the prior expiration date. An approved reestablishment extends the duration of the permit for 18 months from the date the permit expired.

Exceptions:

1. Initial permits for major construction projects that require more than 18 months to complete may be issued for a period that provides reasonable time to complete the work, according to an approved construction schedule. The code official may authorize a permit expiration date not to exceed three years from the date of issuance.
2. The code official may issue permits that expire in less than 18 months if the code official determines a shorter period is appropriate to complete the work.

4.9 Renewal of permits. Permits may be renewed, and renewed permits may be further renewed by the code official, if the following conditions are met:

1. Application for renewal is made within the 30-day period immediately preceding the expiration date of the permit;
2. The project has been issued a master use permit, which has not expired; and
3. If the application for renewal is made more than 18 months after the date of mandatory compliance with a new or revised edition of this code, the permit shall not be renewed unless:
    a. The code official determines that the permit complies, or is modified to comply, with the Seattle Boiler and Pressure Vessel Code in effect on the date of application for renewal; or
    b. The work authorized by the permit is substantially underway and progressing at a rate approved by the building official. “Substantially underway” means that normally required inspections have been approved for work such as foundations, framing, mechanical, and insulation and finish work is being completed on a continuing basis; or
    c. Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes, or other causes related to the work authorized by the permit that are beyond the permit holder’s control.

4.10 Reestablishment of expired permits. A new permit is required to complete work if a permit has expired and was not renewed.

Exception: A permit that expired less than one year prior to the date of a request for reestablishment may be reestablished without the issuance of a new permit upon approval of the code official if it complies with subsections 4.9.2 and 4.9.3 of this code. Once re-established, the permit will not be

considered to have expired. The new expiration date of a re-established permit shall be determined in accordance with subsection 4.8 of this code.

4.11 Revocation of boiler and pressure vessel permits.

Whenever the code official determines there are grounds for revoking a permit, the code official may issue a notice of revocation. The notice of revocation shall identify the reason for the proposed revocation, including, but not limited to, the violations, the conditions violated, and any alleged false or misleading information provided.

4.11.1 Standards for revocation.

The code official may revoke a permit if:

1. This code or the permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation; or
2. The permit was obtained with false or misleading information.

4.11.2 Service of notice of revocation.

The notice of revocation shall be served upon the owner, agent, or other responsible person by personal service or regular first class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first-class mail.

4.11.3 Effective date of revocation.

The code official shall identify in the notice of revocation a date certain on which the revocation will take effect. This date may be stayed pending complete review by the code official pursuant to subsection 4.11.4 of this code.

4.11.4 Review by the code official for notice of revocation.

Any person aggrieved by a notice of revocation may obtain a review by making a request in writing to the code official within three business days of the date of service of the notice of revocation. The review shall occur within five business days after receipt by the building official of the request for review. Any person affected by the notice of revocation may submit additional information to the building official for consideration as part of the review at any time prior to the review.

A. Review procedure. The review will be made by a representative of the code official who will review all additional information received and may also request a site visit. After the review, the code official may:

1. Sustain the notice of revocation and affirm or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Modify the notice of revocation and affirm or modify the date the revocation will take effect; or
4. Continue the review to a date certain.

B. Order of revocation of permit. The code official shall issue an order containing the decision within ten days after the review is completed and shall cause the same to be sent by regular first-class mail to the person or persons requesting the review, any other person on whom the notice of revocation was served, and any other person who requested a copy before issuance of the order. The order of the building official is the final order of the City, and the City and all parties shall be bound by the order.

4.12 Fees. A fee for each boiler and pressure vessel permit and for other activities related to the enforcement of this code shall be paid as set forth in the Fee Subtitle, Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees. The permit fee covers the cost of the inspection to verify that the installation has been completed in accordance with the permit.

4.13 Inspections: General.

4.13.1 Inspection of work. Boilers and pressure vessels for which a permit is required by this code shall be subject to inspection by the code official.

4.13.2 Approval in error. Approval resulting from an inspection shall not be construed to be an approval of a violation of this code or of other ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the City shall not be valid.

4.13.3 Inspector qualifications. City-employed inspectors holding a current Inservice Inspector (IS) Commission issued by the National Board shall conduct the required inspections and use the current edition of the National Board Inspection Code (NBIC), Part 1, as a guide for conducting the inspection. When differences occur between the requirements of this code and other codes and standards, this code shall apply.

Informational Note: The NBIC provides standards for the installation, inspection, and repair and/or alteration of boilers, pressure vessels, and pressure relief devices.

4.13.4 Responsibility for inspection requests. It is the duty of the installer to notify the code official that work requiring inspection as specified in subsection 4.13.1 is ready for inspection.

4.13.5 Access for inspection. The permit holder and the person requesting any inspections required by this code shall provide access to and means for proper inspection of such work. The work shall remain accessible and exposed for inspection purposes. Neither the code official nor the City shall be liable for expenses incurred in the removal or replacement of any material impeding the access necessary to perform required inspections.

4.13.6 Posting permit. The permit holder or permit holder's agent shall post the permit in a conspicuous place on the premises as directed by the code official.

4.13.7 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the code official.

4.13.8 Testing of equipment and systems. The code official may require testing of equipment and systems as part of permit inspections.

4.13.9 Inspections required. The installation of boilers and pressure vessels must be inspected. The following inspections may be required by the code official:

A. Special investigation inspection. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the code official's permission to

proceed, the code official may make a special investigation inspection before a permit is issued for the work. If a special investigation inspection is made, a special investigation fee may be assessed in accordance with the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees.

B. Pre-installation inspection. When the owner or the owner's authorized representative requests inspection of a boiler prior to its installation, the code official shall make the inspection. Any additional inspection outside the scope of the permit may be subject to additional fees in accordance with Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees.

C. Final inspection. When the installation of a boiler or pressure vessel or its auxiliary equipment or related system is complete, a final inspection shall be performed approving the boiler, pressure vessel, auxiliary equipment, or related system as ready for service.

D. Reinspection. The code official may require a reinspection if:

1. Work for which inspection is requested is not complete;
2. Required corrections called for are not made;
3. The permit record is not properly posted on the work site;
4. The approved plans are not readily available to the inspector;
5. Deviations from construction documents that require the approval of the code official have been made without proper approval;
6. Access is not provided on the date requested for the inspection; or
7. Other unforeseen hazards are identified by the code official.

4.13.10 Reinspection fees. The code official may assess a reinspection fee as set forth in the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees, for reinspection. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees are paid.

4.14 Requirements for new installations.

A. On-site. The code official shall require:

1. Boiler installations to have equipment controls set, adjusted, and tested by the installing contractor upon completion.
2. The following documentation to be on site and available to the inspector upon request:
   a. the boiler/pressure vessel permit issued by the code official;
   b. National Board or ASME Data Report(s); and
   c. the manufacturer's installation and operation instructions.
3. Tests deemed necessary to determine that the installation complies with the provisions of this code. Such tests shall be made in the presence of the code official.
4. Access to, and the means for, safe inspection of the installation.

4.15 Testing rental and used boilers.

Rental boilers and used boilers are subject to hydrostatic testing, non-destructive testing, or other special testing as may be required by the code official.

4.16 Combustion air. Combustion air shall be provided in accordance with Chapter 7 of the Seattle Mechanical Code.

4.17 Venting. Venting of combustion byproducts shall be in accordance with Chapter 8 of the Seattle Mechanical Code. Gas-fired appliances shall be vented in accordance with Chapter 5 of the Seattle Fuel Gas Code. Stack dampers on boilers fired with oil or solid fuel shall not close off more than 80 percent of the stack area when closed. Operative dampers shall not be placed within any stack, flue, or vent of a gas-fired boiler, unless the boiler is fired automatically and is equipped with pre-purge, automatic draft control, and draft interlock.

4.18 Controls, safety devices, and instrumentation. Required electrical, mechanical, safety, and operating controls shall carry approval of an approved testing agency. Electrical controls shall be of such design and construction as to be suitable for installation in the environment in which they are located.

4.18.1 Valves. No valve shall be placed between a safety device and the boiler or pressure vessel.

4.18.2 Burners.

A. All burners shall be listed by a nationally recognized testing agency. Burners that are integral parts of boilers shall be listed as part of the overall boiler/burner assembly.

B. Burners capable of burning two or more fuels and installed on or after June 1, 1987, shall be equipped with a fuel selector switch designed and constructed to prevent switching from one fuel to a different fuel without a physical stop in the center/off position.

4.18.3 Gauges. The following gauges are required and shall be kept in good working condition:

A. All steam boilers shall be provided with a pressure gauge and a water level glass; and

B. All water boilers shall be provided with a pressure gauge and a temperature indicator.

4.18.4 Pressure and temperature relief.

A. Overpressure protection. All boilers and pressure vessels shall be protected from excess pressure as specified in the applicable ASME Code Section or recognized standard. Pressure relief devices shall be installed per the applicable ASME Code Section or the manufacturer's requirements, subject to the following additional requirements:

1. Safety relief valves. Safety relief valves on boilers and pressure vessels shall be sized in accordance with the manufacturer's instructions or as approved by the code official.

2. Discharged liquid. The discharge from liquid relief valves shall be piped to within 18 inches of the floor to an open receptacle or floor drain. If the discharged liquid has the potential to exceed 140 degrees F, the discharge shall be cooled prior to entering a drainage system in accordance with the requirements found in the Chapter 8 of the Seattle Plumbing Code.

3. Safety valve discharge. Safety valve discharge from boilers and pressure vessels containing steam shall be directed upward to a minimum of 6 feet above the boiler room floor or horizontally to an inaccessible area of the boiler room. If the discharge from safety valves would result in a hazardous discharge of steam inside the boiler room, or if the discharge of safety valves on boilers exceeds the capacity of 1,000 pounds of steam per hour, the steam discharge

shall be extended outside the boiler room to a safe location. No valve shall be placed on the discharge pipe between the safety relief valve and the atmosphere.

4.18.5 Emergency shutdown switch. Automatically fired boilers exceeding 400,000 BTU/Hr input, or 400,000 BTU/Hr combined capacity in multiple boiler installations, including electric boilers exceeding 117KW, shall have an emergency shut down switch installed outside the boiler room, or in another location approved by the code official. If there is more than one door to the boiler room, there shall be a switch located at each door. The switch shall allow shutdown of all boilers in the boiler room without having to enter the boiler room. The emergency shutdown switch shall be suitable for the intended use and marked for easy identification.

4.18.6 Low-water cutoff or flow-sensing devices.

A. For low-pressure water boilers. Low-pressure water boilers shall be equipped with a manual reset type low-water cutoff device.

1. Low-water cutoff devices shall be mounted so that activation of the device does not damage the boiler or reset the device.
2. Low-water cutoff devices shall be capable of being tested without draining the boiler system.
3. Manually operated and power-actuated isolation valves between the low-water cutoff device and the boiler are prohibited.
4. Delay functions incorporated in any low-water cut-off device requires pre-approval by the code official. Delay functions shall be installed in accordance with the manufacturer's instructions.
5. In installations where two or more low-water cutoff devices are installed, the cutoffs shall be separately piped where feasible.

B. For forced circulation boilers. Boilers that require forced circulation to prevent overheating shall have a flow-sensing device installed in lieu of, or in addition to, the low-water cutoff device.

1. Flow-sensing devices shall be mounted so that activation of the device does not damage the boiler or reset the device.
2. Flow sensing devices shall be testable without draining the boiler system.
3. Delay functions incorporated in any flow-sensing device require pre-approval by the code official. Approved delay functions shall be installed in accordance with the manufacturer's instructions.

C. For steam and power hot-water boilers. Every steam or power hot-water boiler shall be equipped with two low-water cutoff devices. The lower of the two cutoffs shall be equipped with a manual reset device. This device shall be so located as to automatically cut off the fuel supply before the surface of the water falls below the lowest visible part of the water gauge glass.

1. The manual reset device shall be mounted so that activation of the device does not damage the boiler or reset the device.
2. The manual reset device shall be testable without draining the boiler system.
3. Manually operated and power-actuated isolation valves between the low-water cutoff device and the boiler are prohibited.

4. Delay functions incorporated in any low-water cut-off device requires pre-approval by the code official. Approved delay functions shall be installed in accordance with the manufacturer's instructions.
5. In installations where two or more low-water cutoff devices are installed, the cutoffs shall be separately piped where feasible.

Exceptions to subsections 4.18.6.A through 4.18.6.C:

1. Manually fired water and steam boilers.
2. Hot water supply boilers, such as those bearing the ASME "HLW" designator, that are directly connected to and pressurized by the public water supply.

4.18.7 Additional required devices.

A. Temperature control. Water and liquid boilers shall be equipped with two temperature controls, one of which shall have a manual reset device.

B. Pressure control. Steam and vapor boilers shall be equipped with two pressure controls, one of which shall have a manual reset device.

C. Automatic water feeding devices. All steam, vapor, and water boilers shall be equipped with an automatic water feeding device. For steam boilers and boilers having an operating water level, the water feeder shall be controlled by the actual water level in the boiler.

Exception: Manually operated boilers that have a qualified person in constant attendance of the boiler while it is in operation to ensure adequate water feed.

D. Blow-off tank. All steam boilers shall be equipped with a blow-off tank fabricated in accordance with the National Board Blow-off Equipment Standard NB-27. Blow-off tanks shall collect and temper water and steam discharged from safety relief valves and, as applicable, from blow-off and blowdown effluent and low-water fuel cut-off drains. Effluent shall not exceed 140 degrees F prior to entering building drains. (See Seattle Plumbing Code).

Exception: An alternative means for safe discharge may be approved by the code official.

E. Expansion tanks. All closed hot water heating systems shall be provided with an expansion tank. Expansion tanks shall be fabricated to ASME Section IV, HG-709 or HLW-809, as applicable. Expansion tanks shall be sized appropriately and securely fastened to supports that are adequate to support twice the weight of the tank filled with water without placing strain on connecting piping.

F. Manual reset devices. Mechanically fired boilers which require manual ignition or lighting of the burner shall have a manual reset device to prevent automatic recycling in the event of any shut down.

G. Energy management systems. Energy management systems shall not have the ability to override safety devices required by this code. Such systems may only connect to a boiler control system at points provided by the manufacturer for such use.

4.19 Location of boilers and pressure vessels.

4.19.1 Clearance requirements.

When boilers and pressure vessels are installed or replaced, clearance shall be provided to allow access for safe operation, inspection, maintenance, and repair. Passageways around all sides of boilers and pressure vessels shall have an unobstructed width of not less than 18 inches. Clearance for repair and cleaning may be provided through a door or access panel into another area, provided the opening is of sufficient size.

Exception: When approved by the code official, boilers and pressure vessels may be installed with a side clearance of less than 18 inches provided that the lesser clearance does not inhibit inspection, maintenance, or repair or violate the terms of the listing or the manufacturer's installation instructions.

A. Power boilers having a steam generating capacity in excess of 5,000 pounds per hour or having a heating surface in excess of 1,000 square feet or inputs in excess of 5,000,000 Btu/h shall have a minimum clearance of 7 feet from the top of the boiler to the ceiling.

B. The following shall have a minimum clearance of 3 feet from the top of the boiler to the ceiling:

   1. Steam heating boilers and hot water heating boilers that exceed one of the following limits: 5,000,000 Btu/h input, 5,000 pounds steam-per-hour capacity, or 1,000 square-foot heating surface;

   2. Power boilers that do not exceed: 5,000,000 Btu/h input, 5,000 pounds steam-per-hour capacity, or 1,000-square-foot heating surface; and

   3. All boilers with manholes on top of the boiler, except those described in subsection A of this subsection 4.19.1.

C. Package boilers, steam heating boilers, and hot-water heating boilers with no manhole on top of shell and not exceeding one of the limits contained in subsection 4.19.1.B shall have a minimum clearance of 2 feet from the ceiling.

D. Manhole openings shall have a minimum clearance of 5 feet from any outside obstruction.

4.19.2 Underground installations.

Boilers and pressure vessels installed underground shall be enclosed in a concrete or masonry pit. A covered pit shall be equipped with a removable cover so that adequate inspection can be made. Requirements for clearances shall be the same as subsection 4.19.1 of this code.

4.19.3 Boiler rooms.

A. Construction. Boiler rooms shall be constructed in accordance with the current edition of the Seattle Building or Residential Code. Equipment shall be mounted to adequately support the vessel and its contents and keep the equipment level and safely anchored to prevent unwanted movement and damage due to vibration. Floors shall be of noncombustible materials or listed as appropriate for the equipment being mounted. Floors shall have an adequate drain system or legal method of catching and holding liquid wastes incidental to cleaning, recharging, or discharging of safety relief valves.

B. Access platform. Platforms to conduct maintenance and inspection shall be provided to allow safe access and egress to each boiler or pressure vessel.

4.19.4 Garage or warehouse locations. Boilers and pressure vessels installed in garages, warehouses, or other locations where damage from moving vehicles is possible shall be protected with barriers or shall be elevated or located outside the path of vehicles. Boilers, if fuel-fired and installed in garages, shall be at least 18 inches above the floor level. (See Seattle Mechanical Code Section 304.)

Exception: Boilers and pressure vessels installed within a garage may be enclosed in a separate approved compartment having access only from outside the garage if the required combustion air is taken from and discharged to the exterior of the garage.

4.20 Pressure reducing valves.

4.20.1. Limiting equipment pressure. All the equipment downstream of the boiler or pressure vessel shall:

A. Meet the pressure requirements for the MAWP of the boiler or pressure vessel; or

B. Have a pressure reducing system that includes:

1. Safety relief valves. The low-pressure side of the pressure reducing valve shall be protected by one or more safety valves having adequate volume capacity and a set pressure not to exceed the MAWP of equipment or piping installed downstream of the pressure reducing valve;
2. Pressure gauges. Pressure gauges shall be installed on the high and low pressure sides of the pressure reducing valve;
3. Venting. Proper protection shall be provided to prevent injury or damage caused by the discharge of the safety relief valves when vented to the atmosphere; and
4. Bypass valves. The use of a hand-controlled bypass around the reducing valves is allowed. The capacity of the bypass valve shall not exceed the capacity of the reducing valve.

4.21 Fuel piping

4.21.1. Manual shutoff valves. An approved manual shutoff valve shall be installed upstream of all control devices on the main burner of a gas-fired boiler. The takeoff point for the gas supply to the pilot shall be valved separately and be upstream of the gas shutoff valve for the main burner. A union or other approved means of disconnect shall be provided immediately downstream from these shutoff valves.

4.21.2. Gas pressure regulators. An approved gas-pressure regulator shall be installed on gas- fired boilers if the gas supply pressure is higher than that at which the main burner is designed to operate. A separate approved gas-pressure regulator shall be installed to regulate the gas pressure to any pilot.

Exceptions: A separate regulator is not required if the pilot:

1. Is part of a manufacturer-assembled boiler-burner unit approved by the code official;
2. Serves a gas-fired boiler in Group R Occupancies of less than six units; or
3. Serves a gas-fired boiler in Group U Occupancies.

4.21.3 Code compliant. Fuel piping installation shall comply with the provisions of the current edition of the Seattle Fuel Gas Code.

4.22 Steam and hydronic piping.

Steam and hydronic piping systems that are part of a boiler or heating system shall comply with the requirements of the Seattle Mechanical Code, Chapter 12, Hydronic Piping, and the requirements of this code. When piping falls outside the scope of the applicable sections of the above codes, a standard approved by the code official may be used.

4.22.1 Materials and construction.

A. Quality. All piping, tubing, valves, joints, fittings, devices, and materials shall be free of defects and shall comply with nationally recognized standards of construction listed in Section 3 of this code or as approved by the code official.

B. Prohibited. Galvanized piping and fittings are prohibited.

4.23 Elevator machine rooms/spaces and hoistways.

No pipes conveying gases, vapors, or liquids that are not specifically used in the operation of the elevator shall be installed in any elevator hoistway, machine room, or machinery space.

4.24 Alarms.

Alarms such as CO detectors, smoke detectors, CO2 detectors, or other alarms required by this code or other codes are subject to inspection by the code official. Alarms shall be properly maintained and, upon request by the code official, shall be demonstrated to be in good working order.

4.25 Boilers certified as automatic.

The Seattle Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420, provides for reduced attendance requirements for boilers that are certified as automatic. Boilers certified as automatic are required to have the following:

1. Control and limit devices as set forth in Table 4.25 or as certified by the manufacturer if approved by the code official to be equivalent.
2. Feed water systems not requiring manual operation.
3. Stack temperature gauges.
4. Oil temperature and oil suction pressure gauges and/or high and low gas pressure gauges, as applicable.
5. The original equipment manufacturer’s operating and installation manual, together with electrical schematics or diagrams.
6. Boilers 12.5 MM BTU/H and greater. All boilers certified as automatic of 12,500,000 Btu/h input and greater shall also comply with the installation requirements of the current edition of NFPA 85, Boiler and Combustion Systems Hazards Code.
7. Solid fuel boilers. The code official may approve solid-fuel-fired boilers that meet the safety requirements for automatic gas- or oil-fired boilers.

Table 4.25-A

(Part 1 of 2)

Boiler Group	Fuel	Fuel Input[1] Range in BTU/hr. (inclusive)	Type of Pilot[2]	Safety Control Timing (in seconds unless otherwise indicated)				Assured Fuel Supply Control[4]	Assured Fuel Supply Control[5]
					Trial for Main Burner Flame				
				Trial for Pilot	Direct Electric Ignition	Flame Pilot	Main Burner Flame Failure[3]		
A	Gas	0 – 400,000	Any type	90	Not required	90	90	Not required	Required
B	Gas	400,001 – 2,500,000	Any type	15	15	15	2 – 4	Not required	Required
C	Gas	2,500,001 – 12,500,000	Interrupted or intermittent	15	15	15	2 – 4	Required	Required
D	Gas	Over 12,500,000	Interrupted	15	15	15	2 – 4	Required	Required
E	Oil	0 – 400,000	Any type	Not required	90	90	90	Not required	Required
F	Oil	400,001 – 3,000,000	Interrupted	Not required	30	30	2 – 4	Required	Required
G	Oil	3,000,001 – 12,500,000	Interrupted	Not required	15	15	2 – 4	Required	Required
H	Oil	Over 12,500,000	Interrupted	15	15	60	2 – 4	Required	Required
K	Electric	All	Not required	Not required	Not required	Not required	Not required	Not required	Not required

Table 4.25-A
(Part 2 of 2)

Boiler Group	Fuel	Fuel Input Range in BTU/hr. (inclusive)[1]	Low Fire Start Up Control[6]	Pre-purging Control[7]	Hot Water Temperature and Low Water Limit Controls[8]	Steam Pressure and Low Water Limit Controls[9]	Approved Fuel Shutoff[10]	Control and Limit Device System Design[11]
A	Gas	0 – 400,000	Not Required	Not Required	Required	Required	Not Required	Required
B	Gas	400,001 – 2,500,000	Not Required	Not Required	Required	Required	Not Required	Required
C	Gas	2,500,001 – 12,500,000	Required	Required	Required	Required	Required	Required
D	Gas	Over 12,500,000	Required	Required	Required	Required	Required	Required
E	Oil	0 – 400,000	Not Required	Not Required	Required	Required	Not Required	Required
F	Oil	400,001 – 3,000,000	Not Required	Not Required	Required	Required	Not Required	Required
G	Oil	3,000,001 – 12,500,000	Required	Required	Required	Required	Required	Required
H	Oil	Over 12,500,000	Required	Required	Required	Required	Required	Required
K	Electric	All	Not Required	Not Required	Required	Required	Not Required	Required

Footnotes for Table 4.25, Parts 1 and 2.

1. Fuel input shall be determined by one of the following:
   (a) The maximum burner input as shown on the burner nameplate or as otherwise identified by the manufacturer.
   (b) The nominal boiler rating, as determined by the code official, plus 25 percent.
   (c) A permanently affixed meter to indicate fuel consumption, timed to determine the rate of fuel input.
2. Automatic boilers shall have one flame failure device on each burner which shall prove the presence of a suitable ignition source at the point where it will reliably ignite the main burner, except that boiler groups A, B, E, F, and G which are equipped with direct electric ignition shall monitor the main burner, and all boiler groups using interrupted pilots shall monitor only the main burner after the prescribed limited trial and ignition periods. Continuous pilots used in boiler groups A and B shall accomplish 100 percent shutoff upon pilot flame failure. Intermittent pilots may be used in group C for atmospheric burners only, provided the input per combustion chamber does not exceed 5,000,000 Btu/h and modulating or high-low firing is not employed.
3. Continuous pilots provided on manufacturer assembled boiler-burner units must be tested by an approved agency complying with nationally recognized standards and approved by the code official.
4. Boiler groups C and D shall have controls interlocked to accomplish a non-recycling fuel shutoff upon detecting high or low gas pressure. Boiler groups F, G, and H using steam or air for fuel atomization shall have controls interlocked to accomplish a non-recycling fuel shutoff upon detecting low atomizing steam or air pressure. Boiler groups F, G, and H equipped with a preheated oil system shall have controls interlocked to provide fuel shutoff upon detecting low oil temperature.
5. Automatic boilers shall have controls interlocked to shut off the fuel supply in the event of draft failure if forced or induced draft fans are used or, in the event of low combustion air flow, if a gas power burner is used. In boiler groups C, D, G, and H failure to prove the air flow required shall result in a safety shutdown. Where a single motor directly driving both the fan and the oil pump is used, a separate control is not required.
6. Boiler groups C, D, G, and H, when firing in excess of 400,000 Btu per combustion chamber, shall be provided with low fire start of its main burner system to permit smooth light-off. This will normally be a rate of approximately one-third of its maximum firing rate.
7. Boiler groups B, C, D, G, and H shall not permit pilot or main burner trial for ignition operation before a purging operation of sufficient duration to allow a minimum of four complete air changes through the furnace, including combustion chamber and the boiler passes. Where this is not readily determinable, five complete air changes of the

furnace, including combustion chamber up to the first pass, are considered equivalent. An atmospheric gas burner with no mechanical means of creating air movement or an oil burner which obtains two-thirds or more of the air required for combustion without mechanical means of creating air movement shall not require purge by means of four air changes so long as its secondary air openings are not provided with means of closing. If such burners have means of closing secondary air openings, a time delay shall be provided which puts these closures in a normally open position for four minutes before attempting ignition. An installation with a trapped combustion chamber shall always be provided with a mechanical means of creating air movement for purging. Purge air flow in boiler groups C, D, G, and H shall be proved. Proof of purge air flow may be accomplished by providing:

(1) Air pressure and “open damper” interlocks for all dampers in the flow path, or
(2) Air flow interlock.

8. Shall comply with subsection 4.18 of this code.
9. Shall comply with subsection 4.18 of this code.
10. Automatic boilers firing gas or using gas pilots shall be equipped with an approved safety shutoff valve(s) in the main gas burner supply line or pilot gas burner supply line. The safety shutoff valve(s) shall be interlocked to the required programming control devices. Boilers in group C having an input per combustion chamber which does not exceed 5,000,000 Btu/h shall have two safety shutoff valves in series or one safety shutoff valve of the type incorporating a valve seal over travel interlock. Boilers in group C having an input per combustion chamber exceeding 5,000,000 Btu/h and boilers in group D shall have two safety shutoff valves in series and the downstream valve shall be of the type incorporating a valve seal over travel interlock. Boilers in groups C and D using gas in excess of one-half pound per square inch (1/2 lb/in^2) pressure shall be provided with a permanent and ready means for making periodic tightness checks of the main fuel safety shutoff valves. Boilers in group D shall have a normally open electrically operated valve in a vent line between the two safety shutoff valves. This vent shall be sized in accordance with an approved vent sizing table but shall not be less than three-quarters (3/4) inch pipe size. On oil burners where the safety shutoff valve will be subjected to pressures in excess of 10 psig, a second safety shutoff valve shall be provided in series with the first. In boiler group H where a second safety shutoff valve is required, the upstream valve shall be of the 3-way bypass or recirculating type.
11. Control and limit device systems shall be grounded with operating voltage not to exceed 150 volts, except that upon approval by the code official, existing control equipment to be reused in an altered boiler control system may use 220-volt single phase with one side grounded, provided such voltage is used for all controls. Control and limit devices shall interrupt the ungrounded side of the circuit. A readily accessible means of manually disconnecting the control circuit shall be provided with controls arranged so that when they are de-energized the burner shall be inoperative.

4.26 Boilers certified as monitored.

Boilers certified as monitored shall comply with the reduced attendance requirements allowed by the Seattle Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420. The boiler owner or lessee is responsible for compliance with this subsection 4.26.

4.26.1 Definitions related to monitored boiler systems.

For the purposes of this subsection 4.26, certain terms, phrases, words, and their derivatives shall be defined as follows:

CENTRAL STATION AGENCY means a 'Class A' Central Station Agency as defined and approved by the Seattle Fire Department.

MONITORING SYSTEM means a protective alarm signaling system used for surveillance of controls and limit devices required on certain automatic boilers.

ON-SITE MONITORED SYSTEM means a monitoring system with constant supervision by competent and experienced personnel in a central supervising station located on the site where the boiler is installed. The system includes equipment and facilities required to allow the boiler and monitoring system operators to test and operate the system and, upon receipt of a signal, to take responsive action.

SIGNALING SYSTEMS means electrically operated circuits, instruments, and devices, together with the necessary electrical energy designed to transmit alarms and trouble signals to the monitoring system operators to effectively monitor boilers.

4.26.2 Approval of monitoring systems.

A. Status. Monitored boiler status is available only to boilers certified by the code official as automatic boilers.

B. Acceptance tests. Upon completion of system installation, a satisfactory test of the entire installation shall be made in the presence of the City inspector. It shall be the responsibility of the applicant to demonstrate the operation and reliability of the monitoring system during the test of the equipment. The City inspector may require additional tests if deemed necessary for the operation and proper maintenance of the monitoring system and the boiler plant served by such system.

C. Inspection. An inspection by a City inspector may be conducted annually for certification renewal.

D. Listing required. All monitoring system devices shall be listed and labeled by a nationally recognized testing agency.

4.26.3 Signals, personnel, and reporting.

A. Required signals. The following signals are required:

1. Low water level;
2. Flame failure; and
3. Steam pressure at the upper limit setting on steam boilers or water temperature at the upper limit setting on hot water boilers.

Upon sensing any of the above conditions, a signal shall be sent to the monitoring system. The monitoring system shall send a signal if existing limit controls and flame failure devices have caused the boiler to shut down.

B. Monitoring system personnel. The monitoring station shall have sufficient personnel on duty to assure immediate attention to all signals received.

C. Report availability. Reports of all signals received by the monitoring station shall be made available when requested by the code official and as required in this subsection 4.26.3.

D. Disposition of signals. Upon receipt of a signal pertaining solely to matters of equipment maintenance of the signaling systems, the monitoring station operating company shall:

1. Notify the property owner when the function of the signaling system is interrupted and is not corrected within 12 hours;
2. Notify the on-site designated point of contact as soon as possible; and
3. Notify the code official upon receipt of a signal not caused by routine inspection and maintenance.

E. Procedures to be available. Procedures for responding to signals shall be readily available to the on-site designated point of contact and shall include procedures for notifying the boiler supervisor and the code official.

F. Maintenance and repair of monitoring equipment.

1. The monitoring station operating company shall have a person available within two-hours' travel who is competent to inspect, maintain, and repair the monitoring equipment.
2. All monitoring station systems shall be under the supervision of qualified persons. These persons shall cause proper tests and inspection to be made at prescribed intervals and shall have general charge of all alterations and additions to the monitoring system under their supervision or a satisfactory agreement on the maintenance, operation and efficiency of the system shall be provided.

Section 5 – In-service inspections for existing installations

5.1 Duty to inspect. The code official shall inspect or have inspected all boilers and pressure vessels and listed potable water heaters. After satisfactory completion of inspections and upon receipt of fees as set forth in the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees, the code official shall issue a Certificate of Inspection. Inspectors conducting in-service inspections must have current IS Commissions issued by the National Board. Inspectors are required to be either City inspectors or insurance company inspectors.

5.2 In-service inspection. In-service inspections are conducted in accordance with the current edition of the NBIC, Part 2. The code official shall keep a complete record of the type, dimensions, maximum allowable working pressure, age, condition, location, and date of the last recorded internal and external inspections of all boilers and pressure vessels regulated by this code.

5.2.1 Exemptions from in-service inspection. The following boilers, pressure vessels, and other equipment shall not be required to comply with in-service inspection requirements, provided that they do not contain lethal substances:

1. Portable. Portable unfired pressure vessels subject to regular inspection by the State of Washington (chapter 70.79 RCW).

2. **LPG containers.** Containers for liquefied petroleum gases regulated by the Seattle Fire Code.
3. **Specific unfired pressure vessels.** Unfired pressure vessels located in Group B, F, H, M, R, S, and U occupancies having a volume of 5 cubic feet or less and operated at pressures not exceeding 250 psig.
4. **Small unfired pressure vessels.** Regardless of occupancy, unfired pressure vessels that are:
   a. less than 1-1/2 cubic feet in volume (11.22 gallons); or
   b. 6 inches in internal diameter with no limit as to length or pressure.
5. **Pressure relief protected.** Unfired pressure vessels of any size that are protected by approved pressure relief devices set to operate at a designator pressure not exceeding 15 psig or otherwise open to ambient atmospheric pressure.
6. **DOT inspected.** Any boiler or pressure vessel subject to regular inspection by federal inspectors or licensed by federal authorities, such as DOT.
7. **Certain electric boilers.** Electric boilers that meet all of the following criteria:
   a. Having a vessel volume not exceeding 1-1/2 cubic feet (11.22 gallons); and
   b. Having a maximum allowable working pressure of 100 psig; and
   c. If constructed after June 10, 1994, the boiler was constructed to ASME Boiler and Pressure Vessel Code standards, or listed or otherwise certified by a nationally recognized testing agency or recognized foreign testing laboratory.
8. **Storage tanks.** Water storage tanks with no air cushion and no energy or heat source that operate at ambient temperature.
9. **State Owned.** Boilers and pressure vessels under the direct ownership and operation of the State of Washington, and that are inspected in accordance with Washington State Boiler and Pressure Vessel rules (chapter 70.79 RCW) and in possession of a current Washington State Certificate to Operate.
10. **Group R and U occupancies.** Steam heating boilers, low-pressure hot water heating boilers, hot-water-supply boilers, and pressure vessels in Group R occupancies of less than six units and in Group U occupancies.

5.3 In-service inspection frequency.

Inspection frequency shall, at a minimum, be as required by this subsection 5.3. At the discretion of the inspector and as warranted by equipment conditions, the internal, external, or ultrasonic (UT) inspection frequency may be increased until the inspector is satisfied that conditions are corrected and that the minimum prescribed frequencies of inspection may resume.

5.3.1 External inspections.

A. Boiler inspections. Boilers are inspected externally annually. All required boiler controls and safety devices are tested during the external inspection to determine that they are operating properly.

B. Unfired pressure vessel inspections. Unfired pressure vessels are inspected externally biennially.

C. Potable water heaters and pool heaters. In Group A, E, and I occupancies, potable water heaters, combination water heaters (fired, electric, thermal, solar, and indirect), and pool heaters shall be inspected externally biennially for safe condition. The safety inspection consists of lifting the safety

relief try-lever to verify free flow of the safety relief valve and of a visual inspection of the exterior of the vessel for leakage or physical damage.

5.3.2 Internal Inspections. Boilers are subject to internal inspection as follows:

A. Annual inspections. High pressure boilers are inspected internally annually.

B. Biennial inspections.

1. Low pressure steam boilers shall be inspected internally at least once every two years.
2. Unfired pressure vessels, when subject to corrosion and where construction allows, are inspected internally at least once every two years. Subject to the discretion of the inspector, an ultrasonic examination of the external side of the pressure vessel may substitute for an internal inspection.

C. Quadrennial inspections. Low pressure hot water heating boilers not using corrosion inhibitors are inspected internally at least once every four years.

D. Discretionary inspections. Low pressure hot water heating boilers using corrosion inhibitors, glycol, or oil are inspected internally at a frequency determined by the inspector. The inspector shall consider factors including, but not limited to, history of the installation, adequacy of corrosion inhibitors, and tightness of the system.

5.4 Preparation for Inspection.

5.4.1 Boiler preparation. The owner or user shall prepare a boiler for internal inspection as necessary to allow for a meaningful inspection.

A. Preparation. Preparation shall include the following unless directed otherwise by the boiler inspector:

1. Water shall be drained and the boiler thoroughly cleaned.
2. Manhole and handhole plates and wash-out plugs and water column connections shall be removed.
3. Furnace and combustion chambers shall be thoroughly cooled and cleaned.
4. All grates of internally fired boilers shall be removed.
5. Brickwork or refractory shall be removed, if needed, to determine the condition of the boiler headers, furnace, supports, or other parts.
6. Leakage of steam or hot water into the boiler shall be prevented while it is open for inspection.
7. Low water cutout shall be disassembled as necessary to allow for inspection.
8. Compliance with any lock-out or tag-out and confined space entry procedures shall be followed if required by the owner, operator, Occupational Safety and Health Administration rules, Washington Department of Labor and Industries Division of Occupational Safety and Health rules, and other regulations applying to the safety of personnel.

B. Unprepared. If a boiler or unfired pressure vessel has not been properly prepared for an internal inspection, the inspector may decline to make the inspection or test. The Certificate of Inspection will be withheld until the owner or user complies with the inspector’s requirements. At the

discretion of the inspector, an additional inspection fee may be charged per the Fee Subtitle, SMC Title 22, Subtitle IX, Permit Fees.

5.5 Inspection results – Corrections required. The inspector shall notify the owner or authorized representative of defects and deficiencies. It is the responsibility of the owner to promptly and properly make the corrections required by the inspector. If such corrections are not made, or if the operation of the boiler or pressure vessel is deemed unsafe by the inspector, the Certificate of Inspection for the boiler or pressure vessel may be withheld until the corrections are made.

5.6 Inspection by authorized insurance companies. Inspection of boilers and pressure vessels may be made by employees of an authorized insurance company. Such inspection shall be conducted in accordance with the requirements of this code by persons holding an active IS Commission from the National Board.

5.6.1. Inspector list. Authorized insurance companies must annually notify the code official, in writing, of those inspectors that will be conducting inspections within The City of Seattle. Notification shall include the National Board Commission number and expiration date of the inspectors' current National Board Commission. Notification in writing may be on company letterhead or by email. Authorization is subject to the approval of the code official.

5.6.2. Reports. Authorized insurance inspectors shall make their reports to the code official on forms or as prescribed by the Department.

5.6.3. Suspension of coverage. Authorized insurance inspectors shall immediately notify the code official of any suspension of insurance coverage.

5.6.4. New or discontinued coverage. Authorized insurance companies providing insurance coverage of equipment subject to inspection by the code official shall notify the code official within 30 days of any new insurance in effect or any discontinuance of insurance coverage of that equipment.

5.7 Certificate of inspection. It is unlawful to operate any boiler or pressure vessel without first obtaining a valid Certificate of Inspection from the code official. Certificates of Inspection shall be displayed in a conspicuous place adjacent to the boiler or vessel and a copy placed in the service manual. The Certificate of Inspection shall not be issued until the equipment passes inspection and is approved by the code official. A grace period of no longer than 60 days past the expiration date of a Certificate of Inspection may be granted.

5.8 Removal from service due to dangerous conditions. If the operation of a boiler or pressure vessel is deemed by the code official to constitute an imminent hazard, the pressure on such boiler or pressure vessel shall be relieved and the boiler or pressure vessel shall be secured at the owner's expense. The unsafe boiler or pressure vessel shall not be operated without approval of the code official, who may issue an emergency order pursuant to subsection 1.6.7 of this code.

5.9 Operation of boilers and pressure vessels.

5.9.1. Operation. Boilers and pressure vessels shall be operated and maintained by an appropriately licensed boiler operator as required by the Seattle Steam Engineer and Boiler Operator License Code, SMC Chapter 6.420.

5.9.2. Maintenance. Boilers and pressure vessels shall be operated and maintained in a safe condition as required by the code official and in accordance with this code and nationally recognized standards. All safety devices, controls, and appurtenances shall be maintained and cared for throughout the life of the boiler or pressure vessel. When the devices are deemed to be non-functioning, they shall be immediately replaced or repaired, and the vessel made whole and safe to operate.

5.10 Accidents are required to be reported. In case of an explosion or other event rendering a boiler or pressure vessel unsafe to return to operation, notice shall be given immediately to the code official. No boiler or unfired pressure vessel nor any parts shall be removed or disturbed before an inspection is made by a city inspector, except as necessary to prevent injury. The code official shall conduct an investigation to determine the cause of the accident and to recommend actions to prevent future occurrences.

Section 6 – Repairs and alterations

6.1 Repairs and alterations of boilers and pressure vessels.

6.1.1. Pre-approval. Repairs and alterations to in-service boilers and pressure vessels must be approved by the code official prior to proceeding with the repair or alteration and require a permit.

Exception: Routine repairs, as defined by the NBIC Part 3, Repairs and Alterations, do not require a permit.

6.1.2. Code compliance. Repairs or alterations to pressure-retaining portions of the boiler or pressure vessel shall comply with the current edition of this code and the NBIC Part 3, Repairs and Alterations. If there are conflicts between the two codes, this code applies.

6.1.3. Notification. The in-service inspector shall be notified of the nature of the repair or alteration and kept apprised of the progress of the work.

6.1.4. Approval. The repair inspector shall conduct the final inspection and accept the repair or alteration as satisfactory before the boiler or pressure vessel is returned to service.

Exception: Routine repairs do not require a final inspection.

6.1.5. Documentation. Upon completion of the required documentation, the repair organization shall submit a copy to the code official.

Section 7 – Retroactive requirements

7.1 Retroactive requirements. The following requirements apply to all boilers and pressure vessels whether new or existing:

1. Every power hot water boiler, other than manually fired, shall be equipped with at least two temperature controls wired in series.
2. Every steam heating boiler, other than manually fired, shall be equipped with at least two pressure controls and a low-water cutoff device.

3. Each temperature or pressure control shall have an independent sensing element.
4. Every mechanically fired boiler that requires manual ignition of the burner shall have a manual reset device to prevent automatic recycling of the ignition in the event of any shut down.

CHAPTER 1

SCOPE AND ADMINISTRATION

Note: Chapter 1 is entirely Seattle amendments to the *International Building Code* and is not underlined.

SECTION 101
TITLE, PURPOSE AND SCOPE

101.1 Title. This subtitle shall be known as the "Seattle Building Code," may be so cited, and is referred to herein as "this code."

101.2 Scope. This code applies to the construction and occupancy of any building or structure within the City. *Repair*, *alteration*, *change of occupancy*, *addition* to, relocation and maintenance of buildings and structures shall comply with this code as required by the *International Existing Building Code*. This code applies to *unsafe* buildings, structures, equipment and premises. See Chapter 32 for regulation of structures located on, over or under public property or a public right-of-way.

Exceptions:

1. Detached one- and two-family *dwellings* and multiple single-family *dwellings* (townhouses) not more than three *stories above grade plane* in height with a separate means of egress, and their accessory structures not more than three *stories above grade plane* in height, shall comply with the *International Residential Code*.
2. This code does not apply to public utility towers and poles, mechanical equipment not specifically regulated in this code, construction equipment and structural components thereof, and hydraulic flood control structures.

101.2.1 Existing buildings. The *International Existing Building Code* applies to the *repair*, *alteration*, *change of occupancy*, *addition* to, relocation and maintenance of *existing buildings*.

101.3 Applicability of City laws. A building permit application shall be considered under applicable City law in effect on the date a valid and fully complete building permit application is submitted or on a date as otherwise required by law.

Exception: For any project for which an associated, unexpired master use permit has been issued, a building permit application shall be considered under the versions of Seattle Municipal Code Title 23, Seattle *Land Use Code*; Seattle Municipal Code Chapter 25.09, Environmentally Critical Areas regulations; and Seattle Municipal Code Chapter 25.09, Tree Protection regulations in effect on the date established by Seattle Municipal Code Section 23.76.026 or 23.76.032.C.1 for consideration of the master use permit, unless that date is later than the date of the complete building permit application. This exception does not apply to a subdivision or short subdivision component of a master use permit.

Note: Applicable City law includes but is not limited to Seattle Municipal Code Title 23, Seattle *Land Use Code*; Seattle Municipal Code Chapter 25.09, Environmentally Critical Areas regulations; Seattle Municipal Code Chapter 25.11, Tree Protection; and Seattle Municipal Code Title 22, Building and Construction Codes.

101.3.1 Complete building permit applications. A building permit application is complete if the *building official* determines it meets the requirements of Sections 106.5.1 through 106.5.10, and the application includes, without limitation, the *construction documents* for the architectural and structural components of the building.

Exception: If the *building official* allows a building permit application to be submitted in phases for portions of a building, each phased portion submittal shall meet the requirements of Sections 106.5.1 through 106.5.7 applicable to the scope of the allowed phased portion, and the building permit application shall be considered complete for the purposes of Section 101.3 on the date the phased portion submittal that includes the structural frame for the entire building is submitted.

101.3.2 Initial tenant improvements. Complete permit applications for the initial tenant *alterations* submitted no later than 18 months after the date of the *approved* final inspection for the building shall be considered under the codes applicable to the permit application for the building in accordance with Section 101.3.

Complete permit applications for initial tenant *alterations* submitted more than 18 months after the date of the *approved* final inspection for the building shall comply with the codes in effect at the time of application.

101.4 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, occupancy, location and maintenance of buildings and structures within the City and certain equipment specifically regulated herein. The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of *persons* who will or should be especially protected or benefited by the terms of this code.

101.5 Internal consistency. Where in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. Where there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

101.6 Referenced codes and standards. The codes and standards referenced in this code are considered part of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply, except that nothing in this code limits the effect of any provision of the Grading Code, Stormwater Code, or Regulations for Environmentally Critical Areas.

101.7 Appendices. Provisions in the appendices of the *International Building Code* do not apply unless specifically adopted.

101.8 Metric units. Wherever in this code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

SECTION 102
UNSAFE BUILDINGS, STRUCTURES OR PREMISES

102.1 Emergency order. Whenever the *building official* finds that any building or structure or premises, or portion thereof is in such a dangerous and *unsafe* condition as to constitute an imminent hazard to life or limb, the *building official* may issue an emergency order. The emergency order may (1) direct that the building, structure or premises, or portion thereof be restored to a safe condition by a date certain; (2) require that the building, structure or premises, or portion thereof, be vacated within a reasonable time to be specified in the order, or in the case of extreme danger, may specify immediate vacation of the building, structure or premises, or portion thereof; or (3) authorize immediate disconnection of the utilities or energy source.

102.1.1 Service of emergency order. The order shall be posted on the premises or personally served on the owner of the building or premises or any *person* responsible for the condition. The order shall specify the time for compliance.

102.1.2 Effect of emergency order. No *person* may occupy a building, structure or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure or premises, or portion thereof, is restored to a safe condition as required by the order and this code. It is a violation for any *person* to fail to comply with an emergency order issued by the *building official*.

102.2 Hazard correction order. Whenever the *building official* finds that an *unsafe* building, structure or premises exists, the *building official* may issue a hazard correction order specifying the conditions causing the building, structure or premises to be *unsafe* and directing the owner or other *person* responsible for the *unsafe* building, structure or premises to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the *building official* analyzing said conditions and establishing that the building, structure or premises is, in fact, safe. The *building official* may require that the report or analysis be prepared by a licensed engineer and may require compliance with the *International Existing Building Code*.

102.2.1 Service of hazard correction order. The order shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first class mail.

102.2.2 Effect of hazard correction order. It is a violation for any *person* to fail to comply with a hazard correction order as specified in this subsection.

SECTION 103
ENFORCEMENT, VIOLATIONS AND PENALTIES

103.1 Violations. It is a violation of this code for any *person* to:

1. Erect, construct, enlarge, *repair*, move, improve, remove, convert, demolish, equip, occupy, inspect or maintain any building or structure, or cause or permit the same to be done, in the City, contrary to or in violation of any of the provisions of this code;
2. Knowingly aid, abet, counsel, encourage, hire, induce or otherwise procure another to violate or fail to comply with this code;
3. *Use* any material or to install any device, appliance or equipment that does not comply with applicable standards of this code or that has not been approved by the *building official*;
4. Violate or fail to comply with any order issued by the *building official* pursuant to the provisions of this code or with any requirements of this code;

5. Remove, mutilate, destroy or conceal any notice or order issued or posted by the *building official* pursuant to the provisions of this code, or any notice or order issued or posted by the *building official* in response to a natural disaster or other emergency;
6. Conduct work under a permit without requesting an inspection as required by Section 108.

103.2 Notice of violation. If, after investigation, the *building official* determines that standards or requirements of this code have been violated or that orders or requirements have not been complied with, the *building official* may issue a notice of violation upon the owner, agent, or other *person* responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance.

103.2.1 Service of notice of violation. The notice shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail. Nothing in this section limits or precludes any action or proceeding to enforce this code, and nothing obligates or requires the *building official* to issue a notice of violation prior to the imposition of civil or criminal penalties.

103.2.2 Review of notice of violation by the building official. Any *person* affected by a notice of violation issued pursuant to Section 103.2 may obtain a review of the notice by making a request in writing to the *building official* within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or city holiday, the period runs until 5 p.m. of the next business day.

103.2.2.1 Review procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the *building official* unless otherwise agreed to by the *person* requesting the review. Any *person* affected by the notice of violation may submit additional information to the *building official*. The review shall be made by a representative of the *building official* who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and a site visit.

103.2.2.2 Decision. After the review, the *building official* shall:

1. Sustain the notice;
2. Withdraw the notice;
3. Amend the notice; or
4. Continue the review to a date certain.

103.2.2.3 Order. The *building official* shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the *persons* requesting the review and the *persons* named on the notice of violation, addressed to their last known addresses.

103.3 Stop work orders. The *building official* may issue a stop work order whenever any work is being done contrary to the provisions of this code or contrary to a permit issued by the *building official*, or in the event of dangerous or *unsafe* conditions related to construction or demolition. The stop work order shall identify the violation and may prohibit work or other activity on the site.

103.3.1 Service of stop work order. The *building official* shall serve the stop work order by posting it in a conspicuous place at the site. If posting is not physically possible, the stop work order may be served by personal service or by regular first class mail to the last known address of: the property owner, the *person* doing or causing the work to be done, or the holder of a permit if work is being stopped on a permit. For purposes of this section, service is complete at the time of posting or of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or City holiday, the period runs until 5 p.m. on the next business day.

103.3.2 Effective date of stop work order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the *persons* identified in Section 103.3.1 is served.

103.3.3 Review of stop work orders by the building official. Any *person* aggrieved by a stop work order may obtain a review of the order by delivering to the *building official* a request in writing within two business days of the date of service of the stop work order.

103.3.3.1 Review procedure. The review shall occur within two business days after receipt by the *building official* of the request for review unless otherwise agreed by the *person* making the request. Any *person* affected by the stop work order may submit additional information to the *building official* for consideration as part of the review at any time prior to the review. The review will be made by a representative of the *building official* who will review all additional information received and may also request a site visit.

103.3.3.2 Decision. After the review, the *building official* may:

1. Sustain the stop work order;

2. Withdraw the stop work order;
3. Modify the stop work order; or
4. Continue the review to a date certain.

103.3.3.3 Order. The *building official* shall issue an order containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first class mail to the *person* or *persons* requesting the review, any *person* on whom the stop work order was served, and any other *person* who requested a copy before issuance of the order, addressed to their last known address.

103.4 Occupancy violations. Whenever any building or structure is being occupied contrary to the provisions of this code, the *building official* may order such occupancy discontinued and the building or structure, or portion thereof, vacated by notice.

103.4.1 Service of notice of occupancy violation. The notice of occupancy violation shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

103.4.2 Compliance with notice of occupancy violation. Any *person* occupying the building or structure shall discontinue the occupancy by the date specified in the notice of the *building official*, or shall make the building or structure, or portion thereof, comply with the requirements of this code; provided, however, that in the event of an *unsafe* building, Section 102 may apply.

103.5 Civil penalties. Any *person* violating or failing to comply with the provisions of this code shall be subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved, except that the penalty for violations of Section 3107.4.1 shall be $1500 per day. In cases where the *building official* has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

103.6 Enforcement in Municipal Court. Civil actions to enforce Title 22 of the Seattle Municipal Code (SMC) shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of a notice of violation or of an order following a review by the *building official* is not itself evidence that a violation exists.

103.7 Judicial review. Because civil actions to enforce Title 22 SMC must be brought exclusively in Seattle Municipal Court pursuant to Section 103.6, orders of the *building official* including Notices of Violation issued under this chapter are not subject to judicial review pursuant to Chapter 36.70C RCW.

103.8 Alternative criminal penalty. Anyone who violates or fails to comply with any notice of violation or order issued by the *building official* pursuant to this code or who removes, mutilates, destroys or conceals a notice issued or posted by the *building official* shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

103.9 Additional relief. The *building official* may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

103.10 Administrative review by the building official. Prior to issuance of the building permit, applicants may request administrative review by the *building official* of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the *building official*.

103.11 Administrative review by the Construction Codes Advisory Board. After administrative review by the *building official*, and prior to issuance of the building permit, applicants may request review of decisions or actions pertaining to the application and interpretation of this code by the Construction Codes Advisory Board, except for stop work orders, notices of violations, revocations of permits, and enforcement of Section 3107. The review will be performed by three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the *building official*.

103.12 Recording of notices. The *building official* may record a copy of any order or notice with the Department of Records and Elections of King County.

103.13 Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by Title 22 and this code may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

SECTION 104
ORGANIZATION AND DUTIES

104.1 Jurisdiction of Department of Construction and Inspections. The Department of Construction and Inspections is authorized to administer and enforce this code. The Department of Construction and Inspections is under the administrative and operational control of the Director, who is the *building official*.

104.2 Designees. The *building official* may appoint such officers, inspectors, assistants and employees as are authorized from time to time. The *building official* may authorize such employees and other agents as may be necessary to carry out the functions of the *building official*.

104.3 Right of entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the *building official* may enter a building or premises at any reasonable time to perform the duties imposed by this code.

104.4 Modifications. The *building official* may modify the requirements of this code for individual cases provided the *building official* finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety and sanitation when considered together with other safety features of the building or other relevant circumstances. The *building official* may, but is not required to, record the approval of modifications and any relevant information in the files of the *building official* or on the *approved construction documents*.

104.5 Alternate materials, methods of construction and design. This code does not prevent the *use* of any material, design or method of construction not specifically allowed or prohibited by this code, provided the alternate has been approved and its use authorized by the *building official*. The *building official* may approve an alternate, provided the *building official* finds that the proposed alternate complies with the provisions of this code and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation. Certain code alternates have been pre-approved by the *building official* and are identified in this code as numbered code alternates. The *building official* may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The *building official* may, but is not required to, record the approval of code alternates and any relevant information in the files of the *building official* or on the *approved construction documents*.

104.6 Flood hazard areas. The *building official* shall not grant modifications to any provision required in flood hazard areas as established by Section 1612.3 unless a determination has been made that:

1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section 1612 inappropriate.
2. A determination that failure to grant the variance would result in exceptional hardship.
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.
5. Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.

104.7 Tests. Whenever there is insufficient evidence of compliance with any of the provisions of this code or evidence that any material or construction does not conform to the requirements of this code, the *building official* may require tests as proof of compliance to be made at no expense to the City. Test methods shall be specified by this code or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the *building official* shall determine the test procedures. All tests shall be made by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

104.8 Rules of the building official. The *building official* has authority to issue interpretations of this code and to adopt and enforce rules and regulations supplemental to this code as may be deemed necessary in order to clarify the application of the provisions of this code. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this code.

104.8.1 Procedure. The *building official* shall promulgate, adopt and issue rules according to the procedures specified in the Administrative Code, Chapter 3.02 of the Seattle Municipal Code.

104.9 Liability. Nothing in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City, or its officers, employees or agents, for any injury or damage resulting from the failure of a building to conform to the provisions of this code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or

approval authorized or issued or done in connection with the implementation or enforcement of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

This code shall not be construed to relieve or lessen the responsibility of any *person* owning, operating or controlling any building or structure for any damages to *persons* or property caused by defects, nor shall the Department of Construction and Inspections or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

104.10 Responsibilities of parties.

104.10.1 Responsibility for compliance. Compliance with the requirements of this code is the obligation of the owner of the building, structure, or premises, the duly authorized agent of the owner, and other *persons* responsible for the condition or work, and not of the City or any of its officers, employees or agents.

104.10.2 Responsibilities of registered design professional in responsible charge. It is the responsibility of the *registered design professional in responsible charge* to ensure that the information in the *construction documents* is complete, accurate, and, to the best of the design professional's knowledge, conforms to the requirements of this code.

104.10.3 Responsibilities of structural engineer in responsible charge. It is the responsibility of the *structural engineer in responsible charge* to:

1. Design the primary structure;

   Exception: A licensed engineer other than the *structural engineer in responsible charge* may design the primary structure of single-*story* metal buildings.
2. Specify design loads, configurations, controlling dimensions, deflection limits and/or other criteria necessary for the design of secondary structural components and sub-systems and the selection of *structurally qualified products*;
3. Determine the adequacy and conformance of the application of the *structurally qualified products* with the design intent of the City-approved *construction documents*;
4. Review for compatibility with the City-approved *construction documents* previously approved by the *building official*, the *deferred submittals* for the primary structural frame and the design and *deferred submittals* for *secondary members* for the following structural elements:

Wood trusses	Prefabricated stair systems
Steel joists	Post-tensioned floor systems
Precast concrete piles	Precast prestressed planks
Curtain wall systems	Precast concrete/masonry wall panels
Major skylight frames	

The *building official* may approve additions to, or deletions from this list for specific projects. If there is no *structural engineer in responsible charge* on the project, the architect in responsible charge shall assume these responsibilities.

Note: *"Primary structural frame"* and *"secondary member"* are defined in Chapter 2.

104.10.4 Responsibilities of contractor. It is the responsibility of the contractor to perform all the work in conformance with the City-approved *construction documents*.

104.10.5 Responsibilities of plans examiner. It is the responsibility of the plans examiner to verify that the description of the work in the *construction documents* is substantially complete, and to require corrections where, to the best of the plans examiner's knowledge, the *construction documents* do not conform to this code or other pertinent laws and ordinances.

104.10.6 Responsibilities of field inspector. It is the responsibility of the field inspector to conduct inspections to verify that the work in progress conforms with the *approved construction documents* and to require corrections where, to the best of the field inspector's knowledge, the work either does not conform to the *construction documents* or where the work is in violation of this code or other pertinent laws and ordinances.

SECTION 105
CONSTRUCTION CODES ADVISORY BOARD

105.1 Establishment. There is a Construction Codes Advisory Board ("Board") consisting of 13 voting members, appointed by the Mayor and subject to confirmation by the City Council. The Board membership consists of one representative of each of the following professions or organizations. The representative of a profession need not be a member of the profession but may be a representative of an organization of such professionals.

1. One architect;

2. One structural engineer;
3. One electrical engineer;
4. One heating, refrigeration and air-conditioning engineer;
5. One general contractor;
6. One electrical contractor;
7. One commercial building owner or operator;
8. One apartment building owner or operator;
9. One developer and/or contractor of residential projects;
10. One member of organized labor; and
11. Three members of the general public.

A representative of each of the following departments shall be ex officio, non-voting members of the Board:

1. Seattle Fire Department;
2. Seattle City Light; and
3. Seattle-King County Department of Public Health.

105.2 Duties of Board. The Board shall act in an advisory capacity for all of its duties. The Board shall meet on call either by the *building official* or the Board Chair, subject to timely notice.

105.2.1 Code adoption and amendment. The Board may examine proposed new editions and amendments to the following codes and regulations listed in this section. The Board may make recommendations to the *building official* and to the City Council for adoption and amendment of these codes.

1. Seattle Building Code – Chapter 22.101 SMC.*
2. Seattle Residential Code – Chapter 22.101 SMC.
3. Seattle Mechanical Code – Chapter 22.101 SMC.
4. Seattle Fuel Gas Code – Chapter 22.101 SMC.
5. Seattle Boiler Code – Chapter 22.101 SMC.
6. Seattle Energy Code – Chapter 22.101 SMC.
7. Seattle Electrical Code – Chapter 22.101 SMC.
8. Seattle Plumbing Code – Title 22 SMC, Subtitle V.
9. Seattle Wildland-Urban Interface Code – Chapter 22.101 SMC.
10. Seattle Existing Building Code – Chapter 22.101 SMC.

* SMC is the Seattle Municipal Code.

105.2.2 Review of director's rules. The Board may examine proposed administrative rules relating to the codes and regulations listed above and make recommendations to the *building official*.

105.3 Organization. The Board shall organize, and elect a chair and any other officers as may be established by the Board. The Board may adopt rules of procedure. There shall be a committee of the Board for each code assigned to its review. Committees shall consist of Board members and may include additional members such as other representatives of the general public and professions not specifically represented on the Board. Any non-Board members of committees shall be appointed by the Chair. The Chair may, from time to time, appoint special topic subcommittees.

105.4 Terms of service. Terms of Board members are three years, dating from the day of expiration of the preceding term; provided, a member whose term has expired shall continue to serve until a successor is appointed and confirmed. Terms on the Board shall be staggered so that the terms of not more than five positions expire concurrently. Vacancies shall be filled for any unexpired term in the same manner as the original appointment.

105.5 Removal of Board member. A member may be removed by the Mayor, subject to a majority vote of members of the City Council.

105.6 Compensation of Board members. No member shall receive any compensation for service on the Board.

SECTION 106
BUILDING PERMITS

106.1 Permits required. Except as otherwise specifically provided in this code, a building permit shall be obtained from the *building official* for each building or structure prior to erecting, constructing, enlarging, altering, repairing, moving, improv-

ing, removing, changing the occupancy of, or demolishing such building or structure, or allowing the same to be done. All work shall comply with this code, even where no permit is required.

106.2 Work exempt from permit. A building permit is not required for the work listed below. Exemption from the permit requirements of this code does not authorize any work to be done in any manner in violation of this code or any other laws or ordinances of the City.

1. Minor *repairs* or *alterations* if the value of construction, as determined by the *building official*, is $6,000 or less in any six-month period. Such *repairs* and *alterations* shall not include the removal, reduction, *alteration*, or relocation of any loadbearing support. Egress, light, ventilation, and fire-resistance shall not be reduced without a permit.
2. Minor work including the following, provided no changes are made to the building envelope: patio and concrete slabs on grade, painting or cleaning a building, repointing a chimney, installing kitchen cabinets, paneling or other surface finishes over existing wall and ceiling systems applied in accordance with Chapter 8, insulating *existing buildings*, abatement of hazardous materials, demolition of nonstructural interior tenant improvements in retail and office uses, and in-kind or similar replacement of or *repair* of deteriorated members of a structure.
3. One-*story* detached accessory buildings used for greenhouse, tool or storage shed, playhouse, or similar uses, if:
   3.1. The projected roof area does not exceed 120 square feet; and
   3.2. The building is not placed on a concrete foundation other than a slab on grade.
4. Fences not over 8 feet high that do not have masonry or concrete elements above 6 feet.
5. Arbors and other open-framed landscape structures not exceeding 120 square feet in projected area.
6. Display cases, cabinets, counters and partitions not over 5 feet 9 inches high.
7. Retaining walls and rockeries which are not over 4 feet in height measured from the bottom of the footing to the top of the wall, if:
   7.1. There is no surcharge or impoundment of Class I, II or III-A liquids.
   7.2. The wall or rockery is not located in an Environmentally Critical Area (ECA) or ECA buffer pursuant to Chapter 25.09 of the Seattle Municipal Code;
   7.3. Construction does not support soils in a steep slope area, potential landslide area or known slide area as identified in the Seattle Environmentally Critical Areas Ordinance, Section 25.09.030 of the Seattle Municipal Code.
   7.4. Possible failure would likely cause no damage to adjoining property or structures.
8. Platforms, walks and driveways not more than 18 inches above grade and not over any basement or *story* below.
9. Temporary motion picture, television and theater stage sets and scenery.
10. Window *awnings* supported by an exterior wall of Group R-3, and Group U occupancies when projecting not more than 54 inches.
11. Prefabricated swimming pools, spas and similar equipment accessory to a Group R-3 occupancy in which the pool walls are entirely above the adjacent grade and if the capacity does not exceed 5,000 gallons.
12. Replacement of siding. This shall not include structural changes, replacement of sheathing or *alterations* to doors and windows. See Energy Code Sections R503.1.1, Exceptions 2 and 3, and C503.1, Exceptions 3 and 4, for requirements for *existing buildings*.
13. Roof recover.
14 Roof replacement under either of the following conditions:
   14.1. In one- and two-family *dwellings* and townhouses if no changes are made to the building envelope other than adding or replacing insulation, and the insulation value is equivalent to or better than the *existing structure*; or
   14.2. Where less than 500 square feet of roof sheathing or insulation is exposed within any 6 month period. Permits are required for structural changes and replacement of sheathing of any size. See Energy Code Sections R503.1.1, C503.1 and C503.3 for insulation requirements for *existing buildings*.
15. School, park or private playground equipment including tree houses.
16. Removal and/or replacement of underground storage tanks that are subject to regulation by a state or federal agency.

Note: A Fire Department permit is required for removal, replacement and decommissioning of underground storage tanks.

17. Installation of dish and panel antennas 6.56 feet (2 m) or less in diameter or diagonal measurement.
18. Water tanks not located in Environmentally Critical Areas that are supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) and the ratio of height to diameter or width is not greater than 2:1.

106.3 Other permits required. Unless otherwise exempted by this or other pertinent codes, separate master use, plumbing, electrical, mechanical and other permits may be required for the above exempted items.

106.4 Flood hazard areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard, as defined in Seattle Municipal Code Chapter 25.06, are subject to additional standards and requirements, including floodplain development approval or a Floodplain Development License, as set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance.

106.4.1 Determination of substantially improved or substantially damaged existing buildings and structures in flood hazard areas. For applications for reconstruction, rehabilitation, *repair*, *alteration*, *addition* or other improvement of *existing buildings* or structures located in *flood hazard areas*, the *building official* shall determine if the proposed work constitutes *substantial improvement* or *repair* of *substantial damage*. Where the *building official* determines that the proposed work constitutes *substantial improvement* or *repair* of *substantial damage*, and where required by this code, the *building official* shall require the building to meet the requirements of Section 1612.

106.5 Application for permit. To obtain a permit, the applicant shall first file an application in a format determined by the *building official*. Every such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, property address or similar description that will readily identify and definitely locate the proposed building or work.
3. Provide contractor's business name, address, phone number and current contractor registration number (required if contractor has been selected).
4. Be accompanied by *construction documents*, including plans and other data as required in Section 106.5.2 through 106.5.10.
5. State the valuation of any new building or structure or any *addition*, remodeling or *alteration* to an *existing building* including cost breakdown between *additions* and *alterations*.
6. Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority.
7. Give such other data and information as may be required by the *building official*, including, but not limited to, master use and shoreline permits and building identification plans.
8. State the name of the owner and contractor and the name, address and phone number, of a contact *person*.
9. Substantially conform with applicable City law in effect on the date described in Section 101.3, as modified by any exception.
10. Applications that include a grading component shall include all information prescribed by the Grading Code and rules adopted thereunder, and all additional information required by the *building official* pursuant to the Grading Code and rules adopted thereunder.

106.5.1 Construction documents. *Construction documents* shall be submitted in two or more sets with each application for a permit, or shall be submitted in electronic format determined by the *building official*. Computations, stress diagrams, shop and fabrication drawings and other data sufficient to show the adequacy of the plans shall be submitted when required by the *building official*.

Exception: The *building official* may waive the submission of *construction documents*, if the *building official* finds that the nature of the work applied for is such that reviewing of *construction documents* is not necessary to obtain compliance with this code.

106.5.2 Preparation by registered design professionals. *Construction documents* for all work shall be prepared and designed by or under the direct supervision of an architect or structural engineer licensed to practice under the laws of the State of Washington. The registered design professional shall apply their seal and signature to each sheet of the construction documents that is within their scope of qualifications before the permit is issued.

Exceptions:

1. *Construction documents* for work not involving structural design are permitted to be prepared by a registered professional engineer or registered architect qualified in the proposed work.
2. When authorized by the *building official*, *construction documents* for assembly line products or designed specialty structural products may be designed by a registered professional engineer.
3. When authorized by the *building official*, *construction documents* need not be prepared by an engineer or architect licensed by the State of Washington for the following:
   3.1. Detached one- and two-family *dwellings*.

3.2. New buildings or structures, and *additions*, *alterations* or *repairs* made to them of conventional light frame construction, if the value of construction, as determined by the *building official*, is less than $75,000.

3.3. Nonstructural *alterations* and *repairs* if the value of construction, as determined by the *building official*, is less than $75,000, excluding the value of electrical and mechanical systems, fixtures, equipment, interior finish and millwork.

3.4. Other work as specified in rules promulgated by the *building official*.

106.5.3 Design professional in responsible charge. The *building official* is authorized to require the owner to engage and designate on the building permit application a registered design professional who shall act as the registered design professional in responsible charge. If the circumstances require, the owner shall designate a substitute registered design professional in responsible charge who shall perform the duties required of the original registered design professional in responsible charge. The *building official* shall be notified in writing by the owner if the registered design professional in responsible charge is changed or is unable to continue to perform the duties. The registered design professional in responsible charge is responsible for reviewing and coordinating submittal documents prepared by others, including phased and *deferred submittal* items, for compatibility with the design of the building.

106.5.4 Information required on construction documents. *Construction documents* shall include the following, as applicable:

1. A plot plan showing the width of streets, alleys, yards and courts.
2. The location (and/or location within a building), floor area, *story*, height, type of construction and occupancy classification as defined by the Building Code and use as defined by the *Land Use Code* of the proposed building and of every *existing building* on the property.
3. Where there are more than two buildings located on a property, a building identification plan identifying the location of each building on the property and identifying each building by a numbering system unrelated to address. Such plan is not required where a plan for the site is already on file and no new buildings are being added to the site.
4. Types of heating and air conditioning systems.
5. Architectural plans, including floor plans, elevations and door and finish schedules showing location of all doors, windows, mechanical equipment, shafts, pipes, vents and ducts. *Fire walls*, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall or horizontal assembly required to have protected openings or penetrations shall be identified on the architectural plans.
6. Structural plans, including foundation plan and framing plans.
7. Cross-sections and construction details for both architectural and structural plans including wall sections, foundation, floor and roof details, connections of structural members and types of construction material.
8. Topographic plans, including original and final contours, location of all buildings and structures on the site and, when required by the *building official*, adjacent to the site, and cubic yards of cut and fill.
9. If the *building official* has reason to believe that there may be an intrusion into required open areas or over the property line, a survey of the property prepared by a land surveyor licensed by the State of Washington is required for new construction, and for *additions* or accessory buildings.
10. If any building or structure is to be erected or constructed on property abutting an unimproved or partially improved street or alley, the plans shall also include a profile showing the established or proposed grade of the street or alley, based upon information obtained from the Director of Transportation relating to the proposed finished elevations of the property and improvements thereon.
11. Where design flood elevations are not specified, they shall be established in accordance with Section 1612.3.1.
12. Non-structural components: Construction documents shall indicate if structural support and anchoring documentation for nonstructural components is part of the design submittal or a deferred submittal. The construction documents for nonstructural components shall at a minimum identify the following:
    1. All nonstructural components required by ASCE 7 Section 13.1.3 to have an importance factor, Ip, of 1.5.
    2. All mechanical equipment, fire sprinkler equipment, electrical equipment, and other nonstructural components required by ASCE 7 Section 13.1.3 Item 1 to be operational following a seismic event that require designated seismic systems per ASCE 7 Section 13.2.2 and special inspections per Section 1705.13.4.

106.5.5 Information on first sheet. The first or general note sheet of each set of plans shall specify the following, as applicable:

1. The building and street address of the work.
2. The name and address of the owner and *person* who prepared the plans.
3. Legal description of the property.

4. Occupancy classification(s) of all parts of the building(s) and where mixed use and occupancy applies, a diagram of the building or any portion thereof showing how the mixed uses/occupancies are "separated" or "non-separated" per Section 508.
5. Description of fixed fire protection devices or systems for each occupancy, or note "Full" when provided for the entire building.
6. Zoning classification of the property and existing and proposed uses of the structure(s) as defined in the *Land Use Code*.
7. Indication of location within the *fire district* as defined in this code, if applicable.
8. Type of construction as defined in this code.
9. Number of *stories above grade plane, mezzanines* and *basements* as defined in this code.
10. Variances, conditional uses, special exceptions, including project numbers, approval and approval extension dates.
11. Where applicable, a description of the design selected and approved at a Section 403 high-rise building presubmittal conference, a Section 404 atrium presubmittal conference, a Section 909.1.1 smoke control presubmittal conference, a Section 414.1.4 hazardous occupancy presubmittal conference, a Section 1613.1.1 seismic design presubmittal conference or a similar conference on a building subject to Fire Code Chapter 93.

106.5.6 Structural notes. Plans shall include applicable information including, but not limited to, the following:

1. Design loads: Snow load, live loads and lateral loads. If required by the *building official*, the structural notes for plans engineered to ASCE 7 shall include the factors of the base shear formula used in the design;
2. Foundations: Foundation investigations, allowable bearing pressure for spread footings, allowable load capacity of piles, lateral earth pressure;
3. Masonry: Type and strength of units, strength or proportions of mortar and grout, type and strength of reinforcement, method of testing, design strength;
4. Wood: Species or species groups, and grades of sawn lumber, glued-laminated lumber, plywood and assemblies, type of fasteners;
5. Concrete: Design strengths, mix designs, type and strength of reinforcing steel, welding of reinforcing steel, restrictions, if any;
6. Steel and aluminum: Specification types, grades and strengths, welding electrode types and strengths.

In lieu of detailed structural notes the *building official* may approve minor references on the plans to a specific section or part of this code or other ordinances or laws.

106.5.7 Fire-resistive notes. The *building official* may require that plans for buildings more than two *stories* in height of other than Groups R-3 and U occupancies indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing and communication conduits, pipes and similar systems.

The *building official* may require that, when required for fire-resistive construction, the method of installation of wall and ceiling coverings and the protection of structural parts be specified on the plans unless the listing that documents the rating specifies a method no more restrictive than the minimum standards of Chapter 7.

106.5.8 Deferred submittals. Deferral of any submittal items shall have the prior approval of the *building official*. The registered design professional in responsible charge shall list *deferred submittals* on the plans for review by the *building official*.

Documents for *deferred submittal* items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the *building official* with a notation indicating that the *deferred submittal* documents have been reviewed and been found to be in general conformance to the design of the building. The *deferred submittal* items shall not be installed until the *deferred submittal* documents have been approved by the *building official*.

106.5.9 Construction and demolition waste. The information in Sections 106.5.9.1 and 106.5.9.2 shall be submitted for projects generating construction or demolition material for salvage, recycling or disposal. These requirements apply to building *alterations* having a work area greater than 750 square feet or a project value greater than $75,000, whichever is more restrictive, and for all whole building demolitions.

Exception: Projects for which an emergency order or hazard correction order has been issued pursuant to Section 102.

106.5.9.1 Salvage Assessment. This form shall be provided at the time of permit application and is a requirement for permit application submittal.

1. A salvage assessment completed by an approved agent identifying building components having potential to be salvaged prior to building removal. The building owner is permitted to complete the assessment for building *alterations* that include some demolition.

2. A statement of compliance with the regulations of the Puget Sound Clean Air Agency regarding asbestos identification, notification and abatement.

Exception: A salvage assessment is not required if the project does not impact an *existing building*, such as construction of a new detached accessory dwelling unit or backyard cottage.

106.5.9.2 Waste Diversion Report. A Waste Diversion Report shall be submitted within 60 days of final inspection approval. The Waste Diversion Report shall identify the weight or volume of project-generated construction waste and demolition material, the hauler of the material, and the receiving facility or location for each commodity. A signed affidavit from the receiving party and photo documentation shall be included for the salvaged materials for which a tip receipt cannot be obtained.

106.5.10 Clarity of plans. Plans shall be drawn to a clearly indicated and commonly accepted scale in a format determined by the *building official*.

106.6 Application review and permit issuance. The *construction documents* shall be reviewed by the *building official*. Such *construction documents* may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

106.6.1 Determination of completeness. Within 28 days after an application is filed, the *building official* shall notify the applicant in writing either that the application is complete or that it is not complete, and if not complete, what additional information is required to make it complete. Within 14 days after receiving the additional information, the *building official* shall notify the applicant in writing whether the application is now complete or what additional information is necessary. An application shall be deemed to be complete if the *building official* does not notify the applicant in writing by the deadlines in this section that the application is incomplete.

106.6.2 Decision on application. Except as provided in Section 106.6.8, the *building official* shall approve, condition or deny the application within 120 days after the *building official* notifies the applicant that the application is complete.

To determine the number of days that have elapsed after the notification that the application is complete, the following periods shall be excluded:

1. All periods of time during which the applicant has been requested by the Director to correct plans, perform required studies, or provide additional required information, until the determination that the request has been satisfied. The period shall be calculated from the date the *building official* notifies the applicant of the need for additional information until the earlier of the date the *building official* determines whether the additional information satisfies the request for information or 14 days after the date the information has been provided to the *building official*.
2. If the *building official* determines that the information submitted by the applicant under item 1 of this subsection is insufficient, the *building official* shall notify the applicant of the deficiencies, and the procedures under item 1 of this subsection shall apply as if a new request for information had been made.
3. All extensions of time mutually agreed upon by the applicant and the *building official*.

If a project permit application is substantially revised by the applicant, the time period shall start from the date at which the revised project application is determined to be complete under Section 101.3.1.

106.6.3 Issuance of permit.

106.6.3.1. Subject to Section 106.6.3.2, the *building official* shall issue a permit to the applicant if the *building official* finds the following:

1. The work described in the *construction documents* conforms to the requirements of this code and other pertinent laws, ordinances, and regulations and with all conditions imposed under any of them;
2. The fees specified in the *Fee Subtitle* have been paid; and
3. The applicant has complied with all requirements to be performed prior to issuance of a permit for the work under other pertinent laws, ordinances or regulations or included in a master use permit, or otherwise imposed by the *building official*.

When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

106.6.3.2. The *building official* shall not issue a permit if the *building official* has determined that the property owner violated subsection 22.210.136.A of the Seattle Municipal Code and the owner has not obtained any required tenant relocation license.

106.6.4 Phased permits.

1. The *building official* may authorize construction of a portion or portions of a building or structure before complete *construction documents* for the whole building or structure have been submitted or *approved*, or before the applicant has complied with all conditions of a building permit for the entire building or structure under the *Land Use Code* or master use permit. The entire proposed project shall comply with applicable city law in effect on the date set forth in Section 101.3.

The applicant shall proceed at the applicant's risk without assurance that a permit for the entire building or structure will be granted.

2. After approval of a Master Use Permit as required by the *Land Use Code*, if the applicant has satisfied all applicable requirements for issuance of a grading permit under the Grading Code and rules adopted thereunder, a permit for excavation, shoring and other *land-disturbing activity* may be issued.

106.6.5 Grading permits. The grading component of the building permit is the portion of the building permit that authorizes work that is subject to the requirements of the Grading Code. That component constitutes a grading permit.

106.6.6 Permit conditions and denial. The *building official* may impose on a permit any conditions authorized by this code or other pertinent ordinances or regulations, including but not limited to the Grading Code, the Stormwater Code, Regulations for Environmentally Critical Areas, and rules adopted pursuant to those codes. In addition, the *building official* may condition a permit in order to reduce the risks associated with development, construction, ownership and occupancy including, but not limited to risks in potential slide areas. The *building official* may deny a permit if the *building official* determines that the risks cannot be reduced to an acceptable level, that the proposed project or *construction documents* do not conform to the requirements of this code or other pertinent laws, ordinances or regulations, or to requirements included in the Master Use Permit or requirements otherwise imposed by the *building official* or other City departments, or that the applicant has failed to comply with any requirement or condition imposed pursuant to the authority described above.

106.6.7 Compliance with approved construction documents. When the *building official* issues a permit, the *building official* shall endorse the permit in writing or in electronic format, and stamp the plans APPROVED. Such *approved* plans and permit shall not be changed, modified or altered without authorization from the *building official*, and all work shall be done in accordance with the *approved construction documents* and permit except as authorized by the *building official* during a field inspection to correct errors or omissions or as authorized by Section 106.6.8.

106.6.8 Revisions to the permit. When changes to the *approved* work are made during construction, approval of the *building official* shall be obtained prior to execution. The building inspector may approve minor changes to the *construction documents* for work not reducing the structural strength or fire and life safety of the structure. The building inspector shall determine if it is necessary to revise the *approved construction documents*. No changes that are subject to special inspection required by Section 1704 shall be made during construction unless approved by the *building official*. If revised plans are required, changes shall be submitted to and approved by the *building official*, accompanied by fees specified in the *Fee Subtitle* prior to occupancy. All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits.

106.6.9 Cancellation of permit applications. Applications may be cancelled if no permit is issued by the earlier of the following: (1) 12 months following the date of application; or (2) 60 days from the date of written notice that the permit is ready to issue. After cancellation, *construction documents* submitted for review may be returned to the applicant or destroyed by the *building official*.

The *building official* will notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted in order to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

106.6.10 Extensions prior to permit issuance. At the discretion of the *building official*, applications for projects that require more than 12 months to review and approve may be extended for a period that provides reasonable time to complete the review and approval, but in no case longer than 24 months from the date of the original application. No application may be extended more than once. After cancellation, the applicant shall submit a new application and pay a new fee to restart the permit process.

Notwithstanding other provisions of this code, applications may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes or other causes related to the application that are beyond the applicant's control, or while the applicant is making progress toward issuance of a master use permit.

106.7 Retention of plans. One set of *approved* plans, which may be on microfilm or in electronic format, shall be retained by the *building official*. One set of *approved* plans shall be returned to the applicant and shall be kept at the site of the building or work for use by inspection personnel at all times during which the work authorized is in progress.

106.8 Validity of permit. The issuance or granting of a permit or approval of *construction documents* shall:

1. Not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or other pertinent laws and ordinances;
2. Not prevent the *building official* from requiring the correction of errors in the *construction documents* or from preventing building operations being carried on thereunder when in violation of this code or of other pertinent laws and ordinances of the City;
3. Not prevent the *building official* from requiring correction of conditions found to be in violation of this code or other pertinent laws and ordinances of the City; or

4. Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the *building official* or other administrative authority requiring the correction of any such conditions.

106.9 Expiration of permits. Authority to do the work authorized by a permit expires 18 months from the date of issuance. An *approved* renewal extends the life of a permit for an additional 18 months from the prior expiration date. An *approved* reestablishment extends the life of the permit for 18 months from the date the permit expired.

Exceptions:

1. Initial permits for major construction projects that require more than 18 months to complete may be issued for a period that provides reasonable time to complete the work, according to an *approved* construction schedule. The *building official* may authorize a permit expiration date not to exceed three years from the date of issuance, except when there is an associated Shoreline Substantial Development permit in which case the *building official* may authorize an expiration date not to exceed the life of the Shoreline permit.
2. The *building official* may issue permits which expire in less than 18 months if the *building official* determines a shorter period is appropriate to complete the work.

This section is subject to the limitations in Seattle Municipal Code Section 22.800.100, Stormwater Code.

106.10 Renewal of permits. Permits may be renewed and renewed permits may be further renewed by the *building official* if the following conditions are met:

1. Application for renewal is made within the 30-day period immediately preceding the date of expiration of the permit; and
2. If the project has had an associated discretionary Land Use review, the land use approval has not expired; and
3. If an application for renewal is made more than 18 months after the date of mandatory compliance with a new or revised edition of the Seattle Building Code, the permit shall not be renewed unless:
   3.1. The *building official* determines that the permit complies, or is modified to comply, with the Seattle Building, Mechanical, Fuel Gas, Energy, Stormwater, Side Sewer and Grading codes in effect on the date of application for renewal; or
   3.2. The work authorized by the permit is substantially underway and progressing at a rate approved by the *building official*. "Substantially underway" means that normally required building inspections have been *approved* for work such as foundations, framing, mechanical, insulation and finish work that is being completed on a continuing basis; or
   3.3. Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes or other extraordinary circumstances related to the work authorized by the permit, beyond the permit holder's control, subject to approval by the *building official*; and
4. The permit shall not be renewed unless: (a) the *building official* determines that the permit complies, or is modified to comply, with the Seattle Stormwater Code in effect on the date of application for renewal; or (b) construction has started. For purposes of this provision, "started construction" means the site work associated with and directly related to the *approved* project has begun. For example, grading the project site to final grade or utility installation constitutes the start of construction; simply clearing the project site does not.

106.11 Reestablishment of expired permits. A new permit is required to complete work if a permit has expired and was not renewed.

Exception: A permit that expired less than one year prior to the date of a request for reestablishment may be reestablished upon approval of the *building official* if it complies with Section 106.10, Items 2, 3, and 4 above. Once re-established the permit will not be considered to have expired. The new expiration date of a reestablished permit shall be determined in accordance with Section 106.9.

106.12 Revocation of building permits. Whenever the *building official* determines there are grounds for revoking a permit, the *building official* may issue a notice of revocation. The notice of revocation shall identify the reason for the proposed revocation, including but not limited to, the violations, the conditions violated, and any alleged false or misleading information provided.

106.12.1 Standards for revocation. The *building official* may revoke a permit if:

1. The code or the building permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation; or
2. The permit was obtained with false or misleading information.

106.12.2 Service of notice of revocation. The notice of revocation shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address

is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

106.12.3 Effective date of revocation. The *building official* shall identify in the notice of revocation a date certain on which the revocation will take effect. This date may be stayed pending complete review by the *building official* pursuant to Section 106.12.4.

106.12.4 Review by the building official for notice of revocation. Any *person* aggrieved by a notice of revocation may obtain a review by making a request in writing to the *building official* within three business days of the date of service of the notice of revocation. The review shall occur within five business days after receipt by the *building official* of the request for review. Any *person* affected by the notice of revocation may submit additional information to the *building official* for consideration as part of the review at any time prior to the review.

106.12.4.1 Review procedure. The review will be made by a representative of the *building official* who will review all additional information received and may also request a site visit. After the review, the *building official* may:

1. Sustain the notice of revocation and affirm or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Modify the notice of revocation and affirm or modify the date the revocation will take effect; or
4. Continue the review to a date certain.

106.12.4.2 Order of revocation of permit. The *building official* shall issue an order containing the decision within ten days after the review is completed and shall cause the same to be sent by regular first class mail to the *person* or *persons* requesting the review, any other *person* on whom the notice of revocation was served and any other *person* who requested a copy before issuance of the order. The order of the *building official* is the final order of the City, and the City and all parties shall be bound by the order.

106.13 Permits for temporary structures.

106.13.1 Tents and similar facilities used for 18 months or less. The *building official* may issue a permit to erect and maintain a tent or other similar temporary structure to be used for religious services, conventions, circuses, carnivals, fairs, special sales or similar uses for a period not to exceed eighteen months.

Exceptions:

1. Authority to issue permits is vested with the Fire Department for temporary tents and *canopies* meeting all of the following conditions:
   - 1.1. The permit is for less than four weeks;
   - 1.2. The temporary structure will be located 200 feet or more from shorelines;
   - 1.3. No stage, platform, bleacher or similar structure greater than 4 feet in height will be installed inside any temporary structure;
   - 1.4. No temporary structure will be attached to a building or other permanent structure for support;
   - 1.5. The temporary structure is not proposed to be used during severe weather, and
   - 1.6 The temporary structure is not of unusual shape, unusual location or large area or height.

Note: The Land Use and Fire Codes may impose additional restrictions or conditions on tents and temporary structures.

106.13.1.1 Renewal. Permits issued pursuant to Section 106.13.1 are not renewable.

106.13.1.2 Subsequent permits. If the occupant load of the structure is 100 or more and is issued for less than 4 weeks, no more than one permit per tent vendor for each event shall be issued in any three-month period.

106.13.1.3 Removal. Such structures shall be removed before the expiration of the permit.

106.13.1.4 Requirements for tents and similar structures. The structure shall be subject to such reasonable safeguards for *persons* and property as the *building official* prescribes. The nature and extent of fire-extinguishing equipment and decorations shall be subject to the requirements of the fire chief, and the sanitary facilities shall meet the requirements of the Director of Public Health.

106.13.1.5 Cash deposit or bond. The *building official* may require that removal of the structure be guaranteed by a cash deposit with the *building official* or by a surety bond, the amount of which, in either case, shall be fixed by the *building official*. The cash deposit or bond shall also be conditioned so that, if the occupant or owner fails to conform to any of the requirements of the City related to the erection, maintenance or removal of the tent or other structure, the *building official* may enter the premises and take steps necessary to make the structure conform to the requirements. The City shall be permitted to recover the cost thereof from the cash deposit or bond.

106.13.2 Temporary structures. Temporary structures such as reviewing stands and other structures conforming to the requirements of this code, and sheds, *canopies*, or fences used for the protection of the public around and in conjunction with construction work may be erected by special permit from the *building official* for a limited period of time. The building or structure shall be subject to the bonding, removal and safety provisions of Section 106.13.1.5.

106.13.3 Temporary structures in the right-of-way. Temporary buildings or structures in the right-of-way are regulated by the Director of Transportation.

106.13.4 Temporary commercial coaches and modular homes. The *building official* may issue permits for eighteen months for the installation of commercial coaches and modular homes as temporary offices or other uses as may be determined by the *building official*, subject to the following:

1. Commercial coach shall be identified by a State of Washington black sticker located by the door. The structure may be placed on a temporary foundation and shall be anchored to resist wind and seismic lateral forces.
2. Modular homes shall be identified by a State of Washington gold sticker located by the door. Modular homes shall be permitted only if no heavy storage is anticipated for the temporary office use. The structure may be placed on a temporary foundation and shall be anchored to resist wind and seismic lateral forces.
3. A plot plan shall be submitted to verify compliance with the *Land Use Code* and to check exposure to other buildings.
4. The proposed use must be permitted outright under the *Land Use Code* and comply with all other pertinent laws and ordinances.
5. Construction offices, dry shacks and similar temporary buildings are regulated by Section 106.13.5.

106.13.4.1 Renewal of temporary commercial coach and modular home permits. A subsequent permit for another 18 months may be issued at the end of each 18-month period if the *building official* determines that the commercial coach or modular home complies with this section.

106.13.5 Construction buildings. The *building official* may issue a permit to erect and maintain construction offices, dry shacks and similar temporary buildings, including material and equipment storage, for the purpose of constructing an improvement.

Exception: A temporary permit is not required for construction offices and similar temporary buildings located on the same premises for which a construction permit has been issued.

106.13.5.1 Removal of construction buildings. Such structures shall be removed within 14 days after the end of the temporary permit's term. Removal shall be guaranteed by a cash deposit with the *building official* or by a surety bond, the amount of which, in either case, shall be fixed by the *building official*.

106.13.5.2 Requirements for construction buildings. The construction of the structure shall be subject to reasonable safeguards for *persons* and property as the *building official* shall prescribe; the nature and extent of fire-extinguishing equipment shall be subject to the requirements of the fire chief, and the sanitary facilities shall meet the requirements of the Director of Public Health.

106.13.5.3 Cash deposit or bond. The *building official* may require that removal of the structure be guaranteed by a cash deposit with the *building official* or by a surety bond, the amount of which, in either case, shall be fixed by the *building official*. The cash deposit or bond shall be conditioned so that, if the occupant or owner fails to conform to any of the requirements of the City related to the erection, maintenance or removal of the tent or other structure, the *building official* may enter the premises and take steps necessary to make the structure conform to the requirements. The City shall be permitted to recover the cost thereof from the cash deposit or bond.

SECTION 107
FLOOR AND ROOF DESIGN LOADS

107.1 Live loads posted. Where the live loads for which each floor or portion thereof of a commercial or industrial building is or has been designed to exceed 125 pounds per square foot and for all warehouse and storage areas, such design live loads shall be conspicuously posted by the owner or the owner's authorized agent in that part of each *story* in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

107.2 Issuance of certificate of occupancy. A certificate of occupancy required by Section 109 shall not be issued until the floor load signs, required by Section 107.1, have been installed.

107.3 Restrictions on loading. It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

SECTION 108
INSPECTIONS

108.1 General. All construction or work for which a permit is required is subject to inspection by the *building official*, and certain types of construction shall have special inspections by registered special inspectors as specified in Chapter 17.

108.2 Surveys. A survey of the lot may be required by the *building official* to verify compliance of the structure with *approved construction documents*.

108.3 Preconstruction conferences. When required by the *building official*, the owner or the owner's agent shall arrange a conference with the project contractor, the design team, the special inspection agency if special inspection is required, and the *building official* prior to commencing work on any portion of construction. The intent of the conference is to identify and clarify unusual inspection requirements of the project. See Section 1703.7 for preconstruction conferences for projects requiring special inspection.

108.4 Inspection requests. The owner of the property or the owner's authorized agent, or the *person* designated by the owner or agent to do the work authorized by a permit shall notify the *building official* that work requiring inspection as specified in this section and Chapter 17 is ready for inspection.

108.5 Access for inspection. The permit holder and the *person* requesting any inspections required by this code shall provide access to and means for proper inspection of such work, including safety equipment required by Washington Industrial Safety and Health Agency. The work shall remain accessible and exposed for inspection purposes until approved by the *building official*. Neither the *building official* nor the City shall be liable for expense entailed in the required removal or replacement of any material to allow inspection.

108.6 Inspection record. Work requiring a permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position that allows the *building official* to conveniently make the required entries regarding inspection of the work. This record shall be maintained in such a position by the permit holder or the permit holder's agent until final approval has been granted by the *building official*.

108.7 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the *building official*. Written approval shall be given only after an inspection has been made of each successive step in the construction as indicated by each of the inspections required in Section 108.9. There shall be a final inspection and approval of all buildings when completed and ready for occupancy.

108.7.1 Effect of approval. Approval as a result of an inspection is not an approval of any violation of the provisions of this code or of other pertinent laws and ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

108.8 Concealment of work. No required reinforcing steel or structural framework of any part of any building or structure shall be covered or concealed in any manner whatsoever without first obtaining the approval of the *building official*. Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and *approved*.

Exception: Modular homes and commercial coaches identified by State of Washington stickers as specified in Section 106.13.4 and placed upon a permanent foundation approved and inspected by the *building official*.

108.9 Required inspections. The *building official*, upon notification by the permit holder or the permit holder's agent, of the property address and permit number, shall make the following inspections and shall either approve that portion of the construction as completed or shall notify the permit holder or the permit holder's agent if the construction fails to comply with the law.

108.9.1 First ground disturbance inspection. To be made prior to beginning *land-disturbing activity*, and following installation of erosion control measures and any required fencing that may restrict land disturbance in steep slope or other buffers as defined in Seattle Municipal Code Chapter 25.09.

Note: The purpose of the site inspection is to verify the erosion control method, location and proper installation. *Approved* drainage plan requirements and site plan conditions will also be verified, including buffer delineations.

108.9.2 Foundation inspection. To be made after trenches are excavated and forms erected and when all materials for the foundation are delivered on the job. Where concrete from a central mixing plant (commonly termed "ready mix") is to be used, materials need not be on the job.

108.9.3 Concrete slab or under-floor inspection. To be made after all in-slab or under-floor building service equipment, conduit, piping accessories and other ancillary equipment items are in place but before any concrete is poured or floor sheathing installed, including the subfloor.

108.9.4 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.4 shall be submitted to the *building official*.

108.9.5 Frame inspection. To be made after the roof, all framing, fire-blocking and bracing are in place and all pipes, chimneys and vents are complete and the rough electrical, plumbing, and heating wires, pipes and ducts are *approved*.

108.9.6 Type IV-A, IV-B, and IV-C connection protection inspection. In buildings of Type IV-A, IV-B, and IV-C construction, where connection fire resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

108.9.7 Insulation inspection. To be made after all insulation and vapor barriers are in place but before any gypsum board or plaster is applied.

108.9.8 Lath and/or gypsum board inspection. For shear walls, to be made after lathing and/or gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.

108.9.9 Final site inspection. To be made after all grading is complete, and all permanent erosion controls, stormwater facilities and stormwater best management practices have been installed.

Exception: A final site inspection is not required for projects with less than 750 square feet of *land disturbing activity*.

108.9.10 Final inspection. To be made after finish grading and the building is completed and before occupancy.

108.9.10.1 Flood hazard documentation. If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.4 shall be submitted to the *building official* prior to the final inspection.

108.10 Special inspections. For special inspections, see Chapter 17.

108.11 Other inspections. In addition to the called inspections specified above, the *building official* may make or require any other inspections of any construction work or site work to ascertain compliance with the provisions of this code and other pertinent laws and ordinances that are enforced by the *building official*.

108.12 Special investigation. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the *building official*'s permission to proceed, the *building official* may make a special investigation inspection before a permit is issued for the work. Where a special investigation is made, a special investigation fee may be assessed in accordance with the *Fee Subtitle*.

108.13 Reinspections. The *building official* may require a reinspection if work for which inspection is called is not complete, required corrections are not made, the inspection record is not properly posted on the work site, the *approved* plans are not readily available to the inspector, access is not provided on the date for which inspection is requested, or if deviations from *construction documents* that require the approval of the *building official* have been made without proper approval, or as otherwise required by the *building official*.

108.13.1 Compliance with International Existing Building Code Section 101.5. For the purpose of determining compliance with *International Existing Building Code* Section 101.5, Maintenance, the *building official* or the fire chief may cause any structure to be reinspected.

108.13.2 Reinspection fee. The *building official* may assess a reinspection fee as set forth in the *Fee Subtitle* for any action for which reinspection is required. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

SECTION 109
CERTIFICATE OF OCCUPANCY

109.1 Occupancy. No new building or structure shall be used or occupied until the *building official* has issued a Certificate of Occupancy. For *existing buildings*, a Certificate of Occupancy is required for:

1. Any *change of occupancy*,
2. Change in type of construction,
3. Addition, removal or change in type of a fire sprinkler system,
4. Changes in occupant load of an assembly occupancy,
5. Change in the number of *dwelling* units.

Exception: Certificates of occupancy are not required for:

1. Detached Group R-3 occupancies and Group U occupancies accessory to them, provided they shall not be used or occupied until *approved* for occupancy after final inspection.

2. Work exempt from permits under Section 106.2.
3. Work for which a temporary permit was issued under Section 106.13.

109.1.1 Effect of Certificate of Occupancy. Issuance of a Certificate of Occupancy is not approval of any violation of the provisions of this code or other pertinent laws and ordinances of the City. Certificates presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

109.2 Change in occupancy. Changes in the occupancy of a building shall not be made except as specified in the *International Existing Building Code*.

109.3 Certificate issued. After satisfactory completion of inspections, if the *building official* finds that the building or structure requiring a Certificate of Occupancy complies with the provisions of this code, the Fire Code, other pertinent laws, ordinances and regulations of the City, and with all conditions imposed under any of them, and that the applicant has complied with all requirements to be performed prior to issuance of a Certificate of Occupancy in other pertinent laws, ordinances or regulations or in a Master Use Permit, or otherwise imposed by the *building official* or by another City department under any pertinent laws, ordinances or regulations, then the *building official* shall issue a Certificate of Occupancy which shall contain the following information:

1. The building permit number;
2. The address of the building;
3. A description of that portion of the building for which the certificate is issued;
4. A statement that the described portion of the building has been inspected for compliance with the requirements of this; and
5. The name of the *building official*.

109.4 Temporary certificate. A Temporary Certificate of Occupancy may be issued by the *building official* for the use of a portion or portions of a building or structure prior to the completion of the entire building or structure if all devices and safeguards for fire protection and life safety, as required by this code, the Fire Code, and other pertinent laws and ordinances of the City, are maintained in a safe and usable condition.

109.5 Posting. A Certificate of Occupancy shall be posted in a conspicuous place on the premises and shall not be removed except by the *building official*.

109.6 Suspension or revocation of Certificates of Occupancy.

109.6.1 Notice of suspension or revocation. Whenever the *building official* determines there are grounds for suspending or revoking a Certificate of Occupancy, the *building official* may issue a notice of revocation. The notice shall state the reason for suspension or revocation, and shall set the date that the suspension or revocation will take effect if compliance is not achieved by the date set in the notice, which shall be a reasonable time for compliance.

109.6.2 Standards for suspension or revocation of Certificates of Occupancy. The *building official* may suspend or revoke a Certificate of Occupancy if:

1. The certificate is issued in error or on the basis of incorrect information supplied; or
2. It is determined that the building or structure or portion thereof is in violation of any pertinent laws or ordinances of the City or any of the provisions of this code; or
3. When the building, site, applicant, or owner is in violation of any requirement or condition imposed by or pursuant to any other pertinent laws or ordinances of the City that provide for suspension or revocation of a Certificate of Occupancy.

109.6.3 Service of notice of suspension or revocation. The notice of suspension or revocation shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

109.6.4 Effect of notice of suspension or revocation. The notice shall be considered an order of the *building official* if no request for review before the *building official* is made pursuant to Section 109.6.5. Nothing in this subsection shall be deemed to limit or preclude any action or proceeding pursuant to Sections 102 or 103 of this code.

109.6.5 Review of suspension or revocation of Certificate of Occupancy by the building official. Any *person* affected by a notice of revocation issued pursuant to Section 109.6 may obtain a review of the notice by making a request in writing within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or City holiday, the period shall run until 5 p.m. of the next business day.

109.6.5.1 Review procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the *building official* unless otherwise agreed by the *person* requesting the review. Any *person* affected by the notice of revocation may submit additional information to the *building official*. The review shall be made by a repre-

sentative of the *building official* who will review any additional information that is submitted and the basis for issuance of the notice of suspension or revocation. The reviewer may request clarification of the information received and a site visit.

109.6.5.2 Decision. After the review, the *building official* shall:

1. Sustain the notice;
2. Withdraw the notice;
3. Amend the notice; or
4. Continue the review to a date certain.

109.6.5.3 Order. The *building official* shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the *persons* requesting the review and the *persons* named on the notice of violation addressed to their last known address.

SECTION 110
FEES

110.1 Fees. A fee for each building permit and for other activities related to the enforcement of this code shall be paid as set forth in the *Fee Subtitle*.

CHAPTER 2

DEFINITIONS

User notes:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purposes of the code.*

Code development reminder: *Code change proposals to sections preceded by the designation [A] or [BS] will be considered by one of the code development committees meeting during the 2022 (Group B) Code Development Cycle.*

SECTION 201
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

[S] 201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *International Energy Conservation Code*, *International Fuel Gas Code*, *International Fire Code*, *International Mechanical Code* or ((~~*International*~~)) *Uniform Plumbing Code*, such terms shall have the meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

[S] 201.5 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it shall mean the Seattle edition of that code, including any local amendments. References to the "Building Code," "Fire Code," "Mechanical Code" and "Plumbing Code" mean the Seattle editions of those codes.

SECTION 202
DEFINITIONS

[BG] 24-HOUR BASIS. The actual time that a person is an occupant within a facility for the purpose of receiving care. It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

[BS] AAC MASONRY. *Masonry* made of autoclaved aerated concrete (AAC) units, manufactured without internal reinforcement and bonded together using thin- or thick-bed *mortar*.

[BE] ACCESSIBLE. A site, *building*, *facility* or portion thereof that complies with Chapter 11.

[BE] ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any accessible point in a *building* or *facility* to a *public way*.

[BE] ACCESSIBLE ROUTE. A continuous, unobstructed path that complies with Chapter 11.

[BE] ACCESSIBLE UNIT. A *dwelling unit* or *sleeping unit* that complies with this code and the provisions for *Accessible units* in ICC A117.1.

[BS] ACCREDITATION BODY. An *approved*, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

[A] ADDITION. An extension or increase in floor area, number of *stories* or height of a building or structure.

[BS] ADHERED MASONRY VENEER. *Veneer* secured and supported through the adhesion of an *approved* bonding material applied to an *approved* backing.

[BS] ADOBE CONSTRUCTION. Construction in which the exterior *load-bearing* and *nonload-bearing walls* and partitions are of unfired clay *masonry* units, and floors, roofs and interior framing are wholly or partly of wood or other *approved* materials.

Adobe, stabilized. Unfired clay *masonry units* to which admixtures, such as emulsified asphalt, are added during the manufacturing process to limit the units' water absorption so as to increase their durability.

Adobe, unstabilized. Unfired clay *masonry units* that do not meet the definition of "Adobe, stabilized."

[W] ADULT FAMILY HOME. A *dwelling*, licensed by the State of Washington Department of Social and Health Services, in which a person or persons provide personal care, special care, room and board to more than one but not more than six adults who are not related by blood or marriage to the person or persons providing the services. An existing adult family home may provide services to up to eight adults upon approval from the Department of Social and Health Services in accordance with RCW 70.128.066.

[F] AEROSOL CONTAINER. A metal can or plastic container up to a maximum size of 33.8 fluid ounces (1000 ml), or a glass bottle up to a maximum size of 4 fluid ounces (118 ml), designed and intended to dispense an aerosol.

[F] AEROSOL PRODUCT. A combination of a container, a propellant and a material that is dispensed. Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2 or Level 3.

Level 1 aerosol products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

Level 2 aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 aerosol products. Those with a total chemical heat of combustion that is greater than 13,000 Btu/lb (30 kJ/g).

[BS] AGGREGATE. In roofing, crushed stone, crushed slag or water-worn gravel used for surfacing for *roof coverings*.

[BG] AGRICULTURAL BUILDING. A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

[BF] AIR-IMPERMEABLE INSULATION. An insulation having an air permeance equal to or less than 0.02 l/s × m^2 at 75 pa pressure differential tested in accordance with ASTM E283 or ASTM E2178.

[BG] AIR-INFLATED STRUCTURE. A structure that uses air-pressurized membrane beams, arches or other elements to enclose space. Occupants of such a structure do not occupy the pressurized area used to support the structure.

[BG] AIR-SUPPORTED STRUCTURE. A structure wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. *Air-supported structures* are of two basic types:

Double skin. Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.

Single skin. Where there is only the single outer skin and the air pressure is directly against that skin.

[BE] AISLE. An unenclosed *exit access* component that defines and provides a path of egress travel.

[BE] AISLE ACCESSWAY. That portion of an *exit access* that leads to an *aisle*.

[F] ALARM NOTIFICATION APPLIANCE. A *fire alarm system* component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

[F] ALARM SIGNAL. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

[F] ALARM VERIFICATION FEATURE. A feature of *automatic* fire detection and alarm systems to reduce unwanted alarms wherein *smoke detectors* report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

[BS] ALLOWABLE STRESS DESIGN. A method of proportioning structural members, such that elastically computed stresses produced in the members by *nominal loads* do not exceed *specified* allowable stresses (also called "working stress design").

[A] ALTERATION. Any construction or renovation to an *existing structure* other than *repair* or *addition*.

[BE] ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

[BG] AMBULATORY CARE FACILITY. Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than *24-hour basis* to persons who are rendered *incapable of self-preservation* by the services provided or staff has accepted responsibility for care recipients already incapable.

[BG] ANCHOR BUILDING. An exterior perimeter building of a group other than H having direct access to a *covered or open mall building* but having required *means of egress* independent of the mall.

[BS] ANCHORED MASONRY VENEER. *Veneer* secured with *approved* mechanical fasteners to an *approved* backing.

[BF] ANNULAR SPACE. The opening around the penetrating item.

[F] ANNUNCIATOR. A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

[A] APPROVED. Acceptable to the *building official*.

[A] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been *approved* by the *building official*.

[BS] APPROVED FABRICATOR. An established and qualified person, firm or corporation *approved* by the *building official* pursuant to Chapter 17 of this code.

[A] APPROVED SOURCE. An independent person, firm or corporation, *approved* by the *building official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

[BS] AREA (for masonry).

Gross cross-sectional. The *area* delineated by the out-to-out *specified dimensions* of *masonry* in the plane under consideration.

Net cross-sectional. The *area* of *masonry units*, grout and *mortar* crossed by the plane under consideration based on out-to-out *specified dimensions*.

[BG] AREA, BUILDING. The area included within surrounding *exterior walls*, or *exterior walls* and *fire walls*, exclusive of vent *shafts* and *courts*. Areas of the building not provided with surrounding walls shall be included in the *building area* if such areas are included within the horizontal projection of the roof or floor above.

[BE] AREA OF REFUGE. An area where persons unable to use *stairways* can remain temporarily to await instructions or assistance during emergency evacuation.

[BE] AREA OF SPORT ACTIVITY. That portion of an indoor or outdoor space where the play or practice of a sport occurs.

[BG] AREAWAY. A subsurface space adjacent to a building open at the top or protected at the top by a grating or guard.

ASSEMBLY SEATING, MULTILEVEL. See "*Multilevel assembly seating*."

[W] ASSISTED LIVING FACILITY. A home or other institution, licensed by the state of Washington, providing housing, basic services and assuming general responsibility for the safety and well-being of residents under chapters 18.20 RCW and 388-78A WAC. These facilities may provide care to residents with symptoms consistent with dementia requiring additional security measures.

[BG] ATRIUM. A vertical space that is closed at the top, connecting two or more *stories* in Group I-2 and I-3 occupancies or three or more *stories* in all other occupancies.

[BG] ATTIC. The space between the ceiling framing of the top *story* and the underside of the roof.

[F] AUDIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of hearing.

[F] AUTOMATIC. As applied to fire protection devices, a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or combustion products.

[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM. An *approved* system of devices and equipment which automatically detects a fire and discharges an *approved* fire-extinguishing agent onto or in the area of a fire.

[F] AUTOMATIC SMOKE DETECTION SYSTEM. A *fire alarm system* that has initiation devices that utilize *smoke detectors* for protection of an area such as a room or space with detectors to provide early warning of fire.

[F] AUTOMATIC SPRINKLER SYSTEM. An *automatic sprinkler system*, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which *automatic* sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the *fire area*.

[F] AUTOMATIC WATER MIST SYSTEM. A system consisting of a water supply, a pressure source and a distribution piping system with attached nozzles, which, at or above a minimum operating pressure defined by its listing, discharges water in fine droplets meeting the requirements of NFPA 750 for the purpose of the control, suppression or extinguishment of a fire. Such systems include wet-pipe, dry-pipe and preaction types. The systems are designed as engineered, preengineered, local-application or total-flooding systems.

[F] AVERAGE AMBIENT SOUND LEVEL. The root mean square, A-weighted sound pressure level measured over a 24-hour period, or the time any person is present, whichever time period is less.

[S][BG] AWNING. ((~~An architectural projection that provides weather protection, identity or decoration and is partially or wholly supported by the building to which it is attached. An awning is composed of a lightweight *frame structure* over which a covering is attached.~~)) A protective covering with a nonrigid surface projecting from a building.

[S] AWNING SIGN. A sign applied to the surface of an *awning* or *canopy*.

[BF] BACKING. The wall or surface to which the *veneer* is secured.

[BE] BALANCED DOOR. A door equipped with double-pivoted hardware so designed as to cause a semicounterbalanced swing action when opening.

[F] BALED COTTON. A natural seed fiber wrapped in and secured with industry accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).

[F] BALED COTTON, DENSELY PACKED. Cotton made into banded bales with a packing density of not less than 22 pounds per cubic foot (360 kg/m^3), and dimensions complying with the following: a length of 55 inches (1397 mm), a width of 21 inches (533.4 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).

[BS] BALLAST. In roofing, *ballast* comes in the form of large stones or paver systems or light-weight interlocking paver systems and is used to provide uplift resistance for roofing systems that are not adhered or mechanically attached to the roof deck.

[F] BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an *explosion* and which is fully confined, partially vented or fully vented; or other effective method of shielding from *explosive* materials by a natural or artificial barrier.

Artificial barricade. An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

Natural barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing *explosives* when the trees are bare of leaves.

[BS] BASE FLOOD. The *flood* having a 1-percent chance of being equaled or exceeded in any given year.

[BS] BASE FLOOD ELEVATION. The elevation of the *base flood*, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the *Flood Insurance Rate Map* (FIRM).

[BG] BASEMENT. A *story* that is not a *story above grade plane* (see "*Story above grade plane*"). This definition of "Basement" does not apply to the provisions of Section 1612 for *flood loads*.

[BS] BASEMENT (for flood loads). The portion of a building having its floor subgrade (below ground level) on all sides. This definition of "Basement" is limited in application to the provisions of Section 1612.

[BS] BEARING WALL STRUCTURE. A building or other structure in which vertical *loads* from floors and roofs are primarily supported by walls.

[BS] BED JOINT. The horizontal layer of *mortar* on which a *masonry unit* is laid.

[BE] BLEACHERS. Tiered seating supported on a dedicated structural system and two or more rows high and is not a *building element* (see "*Grandstand*").

[BG] BOARDING HOUSE. A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

[F] BOILING POINT. The temperature at which the vapor pressure of a *liquid* equals the atmospheric pressure of 14.7 pounds per square inch (psia) (101 kPa) or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D86 shall be used as the boiling point of the *liquid*.

[W] BOTTLE FILLING STATION. A plumbing fixture connected to the potable water distribution system and sanitary drainage system that is designed and intended for filling personal use drinking water bottles or containers not less than 10 inches (254 mm) in height. Such fixtures can be separate from or integral to a drinking fountain and can incorporate a water filter and a cooling system for chilling the drinking water.

[BS] BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

[BS] BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear *loads* through interaction of framing members, sheathing material and anchors. The panel's length meets the requirements of its particular bracing method and contributes toward the total amount of bracing required along its *braced wall line*.

[BE] BREAKOUT. For revolving doors, a process whereby wings or door panels can be pushed open manually for *means of egress* travel.

[BS] BRICK.

Calcium silicate (sand lime brick). A pressed and subsequently autoclaved unit that consists of sand and lime, with or without the inclusion of other materials.

Clay or shale. A solid or hollow *masonry unit* of *clay or shale*, usually formed into a rectangular *prism*, then burned or fired in a kiln; *brick* is a ceramic product.

Concrete. A concrete *masonry unit* made from Portland cement, water, and suitable aggregates, with or without the inclusion of other materials.

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any occupancy.

BUILDING AREA. See "*Area, building*."

[BG] BUILDING ELEMENT. A fundamental component of building construction, specified in TABLE 601, which may or may not be of fire-resistance-rated construction and is constructed of materials based on the building type of construction.

BUILDING HEIGHT. See "*Height, building*."

[BG] BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[S][A] BUILDING OFFICIAL. The ((~~officer or other designated authority charged with the administration and enforcement of this code~~)) Director of the Seattle Department of Construction and Inspections, or a duly authorized representative.

[BS] BUILDING-INTEGRATED PHOTOVOLTAIC (BIPV) PRODUCT. A building product that incorporates *photovoltaic modules* and functions as a component of the building envelope.

[BS] BUILDING-INTEGRATED PHOTOVOLTAIC ROOF PANEL (BIPV ROOF PANEL). A *photovoltaic panel* that functions as a component of the building envelope.

[BS] BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral *aggregate*, smooth coating or similar surfacing material.

[S][BG] CANOPY. ((~~A permanent structure or architectural projection of rigid construction over which a covering is attached that provides weather protection, identity or decoration. A *canopy* is permitted to be structurally independent or supported by attachment to a building on one or more sides.~~)) A protective covering with a rigid surface projecting from a building. *Marquees* are a type of *canopy*.

[S] CANOPY SIGN. A sign applied to the surface of a *canopy*.

[F] CAPACITOR ENERGY STORAGE SYSTEM. A stationary, rechargeable energy storage system consisting of capacitors, chargers, controls and associated electrical equipment designed to provide electrical power to a building or facility. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.

[F] CARBON DIOXIDE EXTINGUISHING SYSTEMS. A system supplying carbon dioxide (CO_2) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or *automatic*-actuating mechanism.

[F] CARBON MONOXIDE ALARM. A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

[F] CARBON MONOXIDE DETECTOR. A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

[BG] CARE SUITE. In Group I-2 occupancies, a group of treatment rooms, care recipient sleeping rooms and the support rooms or spaces and circulation space within the suite where staff are in attendance for supervision of all care recipients within the suite, and the suite is in compliance with the requirements of Section 407.4.4.

[BS] CAST STONE. A building stone manufactured from Portland cement concrete precast and used as a *trim*, *veneer* or facing on or in buildings or structures.

[F] CEILING LIMIT. The maximum concentration of an airborne contaminant to which one may be exposed. The ceiling limits utilized are those published in DOL 29 CFR Part 1910.1000. The ceiling Recommended Exposure Limit (REL-C) concentrations published by the US National Institute for Occupational Safety and Health (NIOSH), Threshold Limit Value—Ceiling (TLV-C) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), Ceiling Workplace Environmental Exposure Level (WEEL-Ceiling) Guides published by the American Industrial Hygiene Association (AIHA), and other *approved*, consistent measures are allowed as surrogates for hazardous substances not listed in DOL 29 CFR Part 1910.1000.

[BF] CEILING RADIATION DAMPER. A *listed* device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening. Ceiling radiation dampers include air terminal units, ceiling dampers and ceiling air diffusers. Ceiling radiation dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic ceiling radiation damper is tested and rated for closure under elevated temperature airflow.

[BG] CELL (Group I-3 occupancy). A room within a *housing unit* in a detention or correctional facility used to confine inmates or prisoners.

[BS] CELL (masonry). A void space having a gross cross-sectional *area* greater than 1-1/2 square inches (967 mm^2).

[BG] CELL TIER. Levels of *cells* vertically stacked above one another within a *housing unit*.

[BS] CEMENT PLASTER. A mixture of Portland or blended cement, Portland cement or blended cement and hydrated lime, *masonry* cement or plastic cement and aggregate and other *approved* materials as specified in this code.

[BF] CERAMIC FIBER BLANKET. A high-temperature mineral wool insulation material made of alumina-silica ceramic or calcium magnesium silicate soluble fibers and weighing 4 to 10 pounds per cubic foot (pcf) (64 to 160 kg/m^3).

[BS] CERTIFICATE OF COMPLIANCE. A certificate stating that materials and products meet specified standards or that work was done in compliance with *approved construction documents*.

[S][A] CHANGE OF OCCUPANCY. ((~~Either of the following shall be considered as a~~)) A change ((~~of occupancy where this code requires a greater degree of safety, accessibility, structural strength, fire protection, *means of egress*, ventilation or sanitation than is existing in the current~~)) in the use of a building or ((~~structure~~)) portion of a building which results in one of the following:

1. ((~~Any~~)) A change ((~~in the~~)) of occupancy classification. ((~~of a building or structure.~~))
2. ((~~Any~~)) A change ((~~in the purpose of, or a change in the level of activity~~)) from one group to another group within ((~~, a building or structure~~)) an occupancy classification.
3. Any change in use within a group for a specific occupancy classification.

[W] CHILD CARE. The care of children during any period of a 24-hour day.

[W] CHILD CARE, FAMILY HOME. A *child care* facility, licensed by the state of Washington, located in the *dwelling* of the person or persons under whose direct care and supervision the child is placed, for the care of 12 or fewer children, including children who reside at the home.

[M] CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outdoor atmosphere.

Factory-built chimney. A *listed* and *labeled chimney* composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid *masonry units*, bricks, stones, or concrete.

Metal chimney. A field-constructed chimney of metal.

[M] CHIMNEY TYPES.

High-heat appliance type. An *approved* chimney for removing the products of combustion from fuel-burning, high-heat appliances producing combustion gases in excess of 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.3).

Low-heat appliance type. An *approved* chimney for removing the products of combustion from fuel-burning, low-heat appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to 1 hour. Temperatures shall be measured at the appliance flue outlet.

Masonry type. A field-constructed chimney of solid *masonry units* or stones.

Medium-heat appliance type. An *approved* chimney for removing the products of combustion from fuel-burning, medium-heat appliances producing combustion gases not exceeding 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.2).

[BE] CIRCULATION PATH. An exterior or interior way of passage from one place to another for pedestrians.

[F] CLEAN AGENT. Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon vaporation.

[BF] CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in Chapters 3 [CE] and 3 [RE] of the *International Energy Conservation Code*.

[BG] CLINIC, OUTPATIENT. Buildings or portions thereof used to provide *medical care* on less than a *24-hour basis* to persons who are not rendered *incapable of self-preservation* by the services provided.

[W] CLOSED CIRCUIT TELEPHONE. A telephone with a dedicated line such as a house phone, courtesy phone or phone that must be used to gain entrance to a facility.

[F] CLOSED SYSTEM. The *use* of a *solid* or *liquid hazardous material* involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all *uses* of *compressed gases*. Examples of closed systems for *solids* and *liquids* include product conveyed through a piping system into a closed vessel, system or piece of equipment.

[BS] COASTAL A ZONE. Area within a *special flood hazard area*, landward of a V zone or landward of an open coast without mapped *coastal high-hazard areas*. In a *coastal A zone*, the principal source of *flooding* must be astronomical tides, storm surges, seiches or tsunamis, not riverine *flooding*. During the *base flood* conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm). The inland limit of the *coastal A zone* is (a) the *Limit of Moderate Wave Action* if delineated on a FIRM, or (b) designated by the authority having jurisdiction.

[BS] COASTAL HIGH-HAZARD AREA. Area within the *special flood hazard area* extending from offshore to the inland limit of a primary dune along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown on a *Flood Insurance Rate Map* (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30.

[BS] COLLAR JOINT. Vertical longitudinal space between *wythes* of *masonry* or between *masonry wythe* and backup construction that is permitted to be filled with *mortar* or grout.

[BS] COLLECTOR. A horizontal *diaphragm* element parallel and in line with the applied force that collects and transfers *diaphragm* shear forces to the vertical elements of the lateral force-resisting system or distributes forces within the *diaphragm*, or both.

[BF] COMBINATION FIRE/SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to close *automatically* upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a *fire command center*.

[BS] COMBINED PILE RAFT. A geotechnical composite construction that combines the bearing effect of both foundation elements, raft and piles, by taking into account interactions between the foundation elements and the subsoil.

[F] COMBUSTIBLE DUST. Finely divided *solid* material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a US No. 40 standard sieve.

[F] COMBUSTIBLE FIBERS. Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials. This definition does not include densely packed *baled cotton*.

[F] COMBUSTIBLE LIQUID. A *liquid* having a closed cup *flash point* at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

The category of combustible liquids does not include *compressed gases* or *cryogenic fluids* or *liquids* that do not have a fire point when tested in accordance with ASTM D92.

Class II. *Liquids* having a closed cup *flash point* at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. *Liquids* having a closed cup *flash point* at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. *Liquids* having a closed cup *flash point* at or above 200°F (93°C).

[F] COMMERCIAL MOTOR VEHICLE. A motor vehicle used to transport passengers or property where the motor vehicle meets one of the following:

1. Has a gross vehicle weight rating of 10,000 pounds (4540 kg) or more.
2. Is designed to transport 16 or more passengers, including the driver.

[BE] COMMON PATH OF EGRESS TRAVEL. That portion of *exit access* travel distance measured from the most remote point of each room, area or space to that point where the occupants have separate and distinct access to two *exits* or *exit access* doorways.

[BE] COMMON USE. Interior or exterior *circulation paths*, rooms, spaces or elements that are not for public use and are made available for the shared use of two or more people.

[F] COMPRESSED GAS. A material or mixture of materials that meets both of the following:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure.
2. Has a *boiling point* of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially *liquid* at a temperature of 68°F (20°C).
3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

[BS] CONCRETE.

Carbonate aggregate. Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40 percent or less quartz, chert or flint.

Cellular. A lightweight insulating concrete made by mixing a preformed foam with Portland cement slurry and having a dry unit weight of approximately 30 pcf (480 kg/m^3).

Lightweight aggregate. Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m^3).

Perlite. A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m^3) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

Sand-lightweight. Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m^3).

Siliceous aggregate. Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40-percent quartz, chert or flint.

Vermiculite. A light weight insulating concrete made with *vermiculite* concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a Portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m^3).

[BG] CONGREGATE LIVING FACILITIES. A building or part thereof that contains *sleeping units* where residents share bathroom or kitchen facilities, or both.

[F] CONSTANTLY ATTENDED LOCATION. A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

[S][A] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents, in electronic or paper format, prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building *permit* and final approval of construction.

[BG] CONSTRUCTION TYPES. See Section 602.

Type I. See Section 602.2.

Type II. See Section 602.2.

Type III. See Section 602.3.

Type IV. See Section 602.4.

Type V. See Section 602.5.

[BF] CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface of the building envelope.

[F] CONTROL AREA. Spaces within a building where quantities of *hazardous materials* not exceeding the maximum allowable quantities per control area are stored, dispensed, *used* or handled. See the definition of "*Outdoor control area*" in the *International Fire Code*.

[BS] CONTROLLED LOW-STRENGTH MATERIAL. A self-compacted, cementitious material used primarily as a backfill in place of compacted fill.

[BS] CONVENTIONAL LIGHT-FRAME CONSTRUCTION. Construction whose primary structural elements are formed by a system of repetitive wood-framing members. See Section 2308 for conventional *light-frame construction* provisions.

[BG] CORNICE. A projecting horizontal molded element located at or near the top of an architectural feature.

[BE] CORRIDOR. An enclosed *exit access* component that defines and provides a path of egress travel.

CORRIDOR, OPEN-ENDED. See "*Open-ended corridor*."

[BF] CORRIDOR DAMPER. A *listed* device intended for use where air ducts penetrate or terminate at horizontal openings in the ceilings of fire-resistance-rated corridors, where the *corridor* ceiling is permitted to be constructed as required for the *corridor* walls.

[BS] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

[F] CORROSIVE. A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR, Part 173.137, such chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.

[BG] COURT. An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior building walls or other enclosing devices.

[S] COVERED BOAT MOORAGE. A *pier* or system of floating or fixed accessways to which vessels on water may be secured, and any portion of which is covered by a roof.

[BG] COVERED MALL BUILDING. A single building enclosing a number of tenants and occupants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices and other similar uses wherein two or more tenants have a main entrance into one or more malls. *Anchor buildings* shall not be considered as a part of the covered mall building. The term "covered mall building" shall include *open mall buildings* as defined below.

Mall. A roofed or covered common pedestrian area within a *covered mall building* that serves as access for two or more tenants and not to exceed three levels that are open to each other. The term "mall" shall include open malls as defined below.

Open mall. An unroofed common pedestrian way serving a number of tenants not exceeding three levels. Circulation at levels above grade shall be permitted to include open exterior balconies leading to exits discharging at grade.

Open mall building. Several structures housing a number of tenants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses, wherein two or more tenants have a main entrance into one or more open malls. *Anchor buildings* are not considered as a part of the open mall building.

[BS] CRIPPLE WALL. A framed stud wall extending from the top of the foundation to the underside of floor framing for the lowest occupied floor level.

[F] CRITICAL CIRCUIT. A circuit that requires continuous operation to ensure safety of the structure and occupants.

[BS] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element.

[F] CRYOGENIC FLUID. A *liquid* having a *boiling point* lower than -150°F (-101°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101 kPa).

[BG] CUSTODIAL CARE. Assistance with day-to-day living tasks; such as assistance with cooking, taking medication, bathing, using toilet facilities and other tasks of daily living. *Custodial care* includes persons receiving care who have the ability to respond to emergency situations and may receive limited verbal or physical assistance. These care recipients may evacuate at a slower rate and/or who have mental and psychiatric complications.

[BS] DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAMPER. See "*Ceiling radiation damper*," "*Combination fire/smoke damper*," "*Corridor damper*," "*Fire damper*" and "*Smoke damper*."

[S] ((~~[BS] DANGEROUS.~~ ~~Any building, structure or portion thereof that meets any of the conditions described below shall be deemed *dangerous*:~~

1. ~~The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.~~
2. ~~There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine, or frequent *loads;* under actual loads already in effect; or under snow, wind, rain, *flood*, earthquake, or other environmental loads when such *loads* are imminent.~~))

[F] DAY BOX. A portable magazine designed to hold *explosive* materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56 of the *International Fire Code*.

[BS] DEAD LOAD. The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, *stairways*, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and the weight of fixed service equipment, including cranes and material handling systems.

[BS] DECORATIVE GLASS. A carved, leaded or *Dalle glass* or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

[F] DECORATIVE MATERIALS. All materials applied over the building *interior finish* for decorative, acoustical or other effect including, but not limited to, curtains, draperies, fabrics and streamers; and all other materials utilized for decorative effect including, but not limited to, bulletin boards, artwork, posters, photographs, batting, cloth, cotton, hay, stalks, straw, vines, leaves, trees, moss and similar items, foam plastics and materials containing foam plastics. Decorative materials do not include wall coverings, ceiling coverings, floor coverings, ordinary window shades, *interior finish* and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

[BS] DEEP FOUNDATION. A deep foundation is a foundation element that does not satisfy the definition of a *shallow foundation*.

[BE] DEFEND-IN-PLACE. A method of emergency response that engages building components and trained staff to provide occupant safety during an emergency. Emergency response involves remaining in place, relocating within the building, or both, without evacuating the building.

[S][A] DEFERRED SUBMITTAL. Those portions of the design that are not submitted at the time of the application and that are to be submitted to the *building official* within a specified period. <u>*Deferred submittals* include but are not limited to shop drawings for truss systems and sprinkler systems.</u>

[F] DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

[BF] DELAYED-ACTION CLOSER. A *self-closing* device that incorporates a delay prior to the initiation of closing. Delayed-action closers are mechanical devices with an adjustable delay.

[F] DELUGE SYSTEM. A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

[BS] DESIGN EARTHQUAKE GROUND MOTION. The earthquake ground motion that buildings and structures are specifically proportioned to resist in Section 1613.

[BS] DESIGN FLOOD. The *flood* associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of *flooding* in any year.
2. Area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated.

[BS] DESIGN FLOOD ELEVATION. The elevation of the "*design flood*," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

DESIGN PROFESSIONAL, REGISTERED. See "*Registered design professional*."

DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE, REGISTERED. See "*Registered design professional in responsible charge*."

[BS] DESIGN STRENGTH. The product of the nominal strength and a *resistance factor* (or strength reduction factor).

[BS] DESIGNATED SEISMIC SYSTEM. Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor, I_p, is greater than 1 in accordance with Section 13.1.3 of ASCE 7.

[F] DETACHED BUILDING. A separate single-story building, without a *basement* or crawl space, used for the storage or *use* of *hazardous materials* and located an *approved* distance from all structures.

[BS] DETAILED PLAIN CONCRETE STRUCTURAL WALL. See Section 1905.1.1.

[BE] DETECTABLE WARNING. A standardized surface feature built in or applied to walking surfaces or other elements to warn visually impaired persons of hazards on a *circulation path*.

[F] DETECTOR, HEAT. A fire detector that senses heat—either abnormally high temperature or rate of rise, or both.

[F] DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

[BG] DETOXIFICATION FACILITIES. Facilities that provide treatment for substance abuse, serving care recipients who are *incapable of self-preservation* or who are harmful to themselves or others.

[BS] DIAPHRAGM. A horizontal or sloped system acting to transmit lateral forces to vertical elements of the lateral force-resisting system. When the term "*diaphragm*" is used, it shall include horizontal bracing systems.

Diaphragm, blocked. In *light-frame construction*, a diaphragm in which all sheathing edges not occurring on a framing member are supported on and fastened to blocking.

Diaphragm boundary. In *light-frame construction*, a location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

Diaphragm chord. A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment.

Diaphragm, unblocked. A diaphragm that has edge nailing at supporting members only. Blocking between supporting structural members at panel edges is not included. Diaphragm panels are field nailed to supporting members.

[BS] DIMENSIONS. This definition applies only to Chapter 21.

Nominal. The *specified dimension* plus an allowance for the *joints* with which the units are to be laid. Nominal *dimensions* are usually stated in whole numbers. Thickness is given first, followed by height and then length.

Specified. *Dimensions* specified for the manufacture or construction of a unit, *joint* or element.

[BE] DIRECT ACCESS. A path of travel from a space to an immediately adjacent space through an opening in the common wall between the two spaces.

[F] DISPENSING. The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

[S] DISPLAY SURFACE. The area of a *sign structure* used to display the message.

DOOR, BALANCED. See "*Balanced door*."

DOOR, LOW-ENERGY POWER-OPERATED. See "*Low-energy power-operated door*."

DOOR, POWER-ASSISTED. See "*Power-assisted door*."

DOOR, POWER-OPERATED. See "*Power-operated door*."

DOORWAY, EXIT ACCESS. See "*Exit access doorway*."

[BG] DORMITORY. A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college *dormitories* or fraternity houses.

[BF] DRAFTSTOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and *attics*.

DRAG STRUT. See "*Collector*."

[BS] DRILLED SHAFT. A cast-in-place *deep foundation* element, also referred to as a caisson, drilled pier or bored pile, constructed by drilling a hole (with or without permanent casing or drilling fluid) into soil or rock and filling it with fluid concrete after the drilling equipment is removed.

Socketed drilled shaft. A drilled shaft with a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock.

[BS] DRY FLOODPROOFING. A combination of design modifications that results in a building or structure, including the attendant utilities and equipment and sanitary facilities, being water tight with walls substantially impermeable to the passage of water and with structural components having the capacity to resist *loads* as identified in ASCE 7.

[F] DRY-CHEMICAL EXTINGUISHING AGENT. A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

[A] DWELLING. A building that contains one or two *dwelling units* used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

[A] DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

[BG] DWELLING UNIT, EFFICIENCY. A *dwelling unit* where all permanent provisions for living, sleeping, eating and cooking are contained in a single room.

DWELLING UNIT OR SLEEPING UNIT, MULTISTORY. See "*Multistory unit*."

[BE] EGRESS COURT. A *court* or *yard* which provides access to a *public way* for one or more *exits*.

[S] ELECTRIC SIGN. Any sign containing electrical wiring, but not including signs illuminated by an exterior light source.

[BG] ELECTRIC VEHICLE CHARGING STATION. One or more vehicle spaces served by an electric vehicle charging system.

[BF] ELECTRICAL CIRCUIT PROTECTIVE SYSTEM. A specific construction of devices, materials, or coatings installed as a fire-resistive barrier system applied to electrical system components, such as cable trays, conduits and other raceways, open run cables and conductors, cables, and conductors.

[F] ELEVATOR GROUP. A grouping of elevators in a building located adjacent or directly across from one another that responds to common hall call buttons.

[F] EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving *hazardous materials*.

[F] EMERGENCY CONTROL STATION. An *approved* location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

((~~**[F] EMERGENCY POWER SYSTEM.** A source of *automatic* electric power of a required capacity and duration to operate required life safety, fire alarm, detection and ventilation systems in the event of a failure of the primary power. Emergency power systems are required for electrical loads where interruption of the primary power could result in loss of human life or serious injuries.~~))

[S] EMERGENCY POWER SYSTEM. An electrical system that complies with Seattle Electrical Code Article 700.

[F] EMERGENCY VOICE/ALARM COMMUNICATIONS. Dedicated manual or *automatic* facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

[BF] EMITTANCE. The ratio of radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

[BE] EMPLOYEE WORK AREA. All or any portion of a space used only by employees and only for work. *Corridors*, toilet rooms, kitchenettes and break rooms are not employee work areas.

[F] ENERGY STORAGE SYSTEM, ELECTROCHEMICAL. An energy storage system that stores energy and produces electricity using chemical reactions. It includes, among others, battery ESS and capacitor ESS.

[BS] ENGINEERED WOOD RIM BOARD. A full-depth *structural composite lumber*, *wood structural panel*, structural glued laminated timber or *prefabricated wood I-joist* member designed to transfer horizontal (shear) and vertical (compression) *loads*, provide attachment for *diaphragm* sheathing, siding and exterior deck ledgers, and provide lateral support at the ends of floor or roof joists or rafters.

ENTRANCE, PUBLIC. See "*Public entrance*."

ENTRANCE, RESTRICTED. See "*Restricted entrance*."

ENTRANCE, SERVICE. See "*Service entrance*."

[BG] EQUIPMENT PLATFORM. An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, *stairways, alternating tread devices* and ladders necessary to access the platform (see Section 505.3).

[BS] ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from *flood*, wind, snow or earthquakes.

[F] EXHAUSTED ENCLOSURE. An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general *ventilation*, in themselves, are not exhausted enclosures.

[S][A] EXISTING BUILDING, EXISTING STRUCTURE (Except for Section 1612.2). A building or structure erected prior to the date of adoption of the appropriate code, or one for which a ((~~legal building *permit*~~)) valid Certificate of Occupancy has been issued, or one that has passed a final inspection.

[S] ((~~[BS] EXISTING STRUCTURE. A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building *permit* has been issued.~~))

[BE] EXIT. That portion of a *means of egress* system between the *exit access* and the *exit discharge* or *public way*. Exit components include exterior exit doors at the *level of exit discharge*, *interior exit stairways* and *ramps*, *exit passageways*, *exterior exit stairways* and *ramps* and *horizontal exits*.

EXIT, HORIZONTAL. See "*Horizontal exit*."

[BE] EXIT ACCESS. That portion of a *means of egress* system that leads from any occupied portion of a building or structure to an *exit*.

[BE] EXIT ACCESS DOORWAY. A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, *corridor*, *exit access stairway* or *ramp*.

[BE] EXIT ACCESS RAMP. A *ramp* within the *exit access* portion of the *means of egress* system.

[BE] EXIT ACCESS STAIRWAY. A *stairway* within the *exit access* portion of the *means of egress* system.

[BE] EXIT DISCHARGE. That portion of a *means of egress* system between the termination of an *exit* and a *public way*.

[BE] EXIT DISCHARGE, LEVEL OF. The *story* at the point at which an *exit* terminates and an *exit discharge* begins.

[S][BE] EXIT PASSAGEWAY. An *exit* component that ((~~is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and~~)) provides for a protected path of egress travel in a horizontal direction to an *exit* or to the *exit discharge*.

[BF] EXPANDED VINYL WALL COVERING. Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

[F] EXPLOSION. An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, *deflagration* or *detonation*, decomposition of molecules and runaway polymerization (usually *detonations*).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

[F] EXPLOSIVE. A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to: dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G by the *hazardous materials* regulations of DOTn 49 CFR Parts 100-185.

High explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to: black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks; and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

[F] FABRICATION AREA. An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

[A] FACILITY. All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a *site*.

[BS] FACTORED LOAD. The product of a *nominal load* and a load factor.

[S] FEE SUBTITLE. Seattle Municipal Code Title 22, Subtitle IX.

[BS] FENESTRATION. Products classified as either *vertical fenestration* or *skylights and sloped glazing*, installed in such a manner as to preserve the weather-resistant barrier of the wall or roof in which they are installed. *Fenestration* includes products with glass or other transparent or translucent materials.

[BS] FENESTRATION, VERTICAL. Windows that are fixed or movable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors installed in a wall at less than 15 degrees from the vertical.

[BS] FIBERBOARD. A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (pcf) (497 kg/m^3) but more than 10 pcf (160 kg/m^3).

[BS] FIBER-CEMENT (BACKER BOARD, SIDING, SOFFIT, TRIM AND UNDERLAYMENT) PRODUCTS. Manufactured thin section composites of hydraulic cementitious matrices and discrete nonasbestos fibers.

[BF] FIBER-REINFORCED POLYMER. A polymeric composite material consisting of reinforcement fibers, such as glass, impregnated with a fiber-binding polymer which is then molded and hardened. Fiber-reinforced polymers are permitted to contain cores laminated between fiber-reinforced polymer facings.

FIELD NAILING. See "*Nailing, field*."

FIRE ALARM BOX, MANUAL. See "*Manual fire alarm box*."

[F] FIRE ALARM CONTROL UNIT. A system component that receives inputs from *automatic* and manual *fire alarm* devices and may be capable of supplying power to detection devices and transponders or off-premises transmitters. The control unit may be capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

[F] FIRE ALARM SIGNAL. A signal initiated by a *fire alarm-initiating device* such as a *manual fire alarm box*, *automatic fire detector*, waterflow switch or other device whose activation is indicative of the presence of a fire or fire signature.

[F] FIRE ALARM SYSTEM. A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of *fire alarm* or *supervisory signal-initiating devices* and to initiate the appropriate response to those signals.

[BF] FIRE AREA. The aggregate floor area enclosed and bounded by *fire walls*, *fire barriers*, *exterior walls* or *horizontal assemblies* of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

[BF] FIRE BARRIER. A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

[S] FIRE CODE OFFICIAL. The chief of the Seattle Fire Department or a duly authorized representative.

[F] FIRE COMMAND CENTER. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the systems can be manually controlled.

[BF] FIRE DAMPER. A *listed* device installed in ducts and air transfer openings designed to close automatically upon detection of heat and resist the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

[S] FIRE DETECTION SYSTEM. A system of smoke or heat detectors monitored at an *approved* central station, with no requirement for notification appliances in the building.

[F] FIRE DETECTOR, AUTOMATIC. A device designed to detect the presence of a fire signature and to initiate action.

[S] FIRE DISTRICT. That part of the city within the boundary described as follows:

Beginning at the intersection of the center line of Alaskan Way and Clay Street; thence northeasterly along the center line of Clay Street to an intersection with the center line of Denny Way; thence easterly along the center line of Denny Way to an intersection with the center line of Yale Avenue; thence southeasterly along the center line of Yale Avenue to an intersection with the center line of Interstate Highway 5; thence southerly and southeasterly along the centerline of Interstate Highway 5 to an intersection with the center line of 7th Avenue South; thence southerly along the center line of 7th Avenue South to an intersection with the center line of Dearborn Street; thence westerly along the center line of Dearborn Street to an intersection with the center line of Airport Way; thence northwesterly along the center line of Airport Way to an inter-

section with the center line of 4th Avenue South; thence southerly along the center line of 4th Avenue South to an intersection with the center line of South Royal Brougham Way; thence westerly along the center line of South Royal Brougham Way to an intersection with the center line of South Alaskan Way; thence southerly along the center line of South Alaskan Way to an intersection with the center line of South Massachusetts Street, thence westerly along the center line of South Massachusetts Street to the Outer Harbor Line in Elliott Bay, thence northerly and northwesterly along the Outer Harbor Line to an intersection with the center line of West Harrison Street, thence easterly along the center line of West Harrison Street to an intersection with the center line of Alaskan Way, then southeasterly along the center line of Alaskan Way to the point of beginning.

Buildings and structures located partially within and partially outside the *Fire District* are considered to be located in the *Fire District*. See Figure 202F.

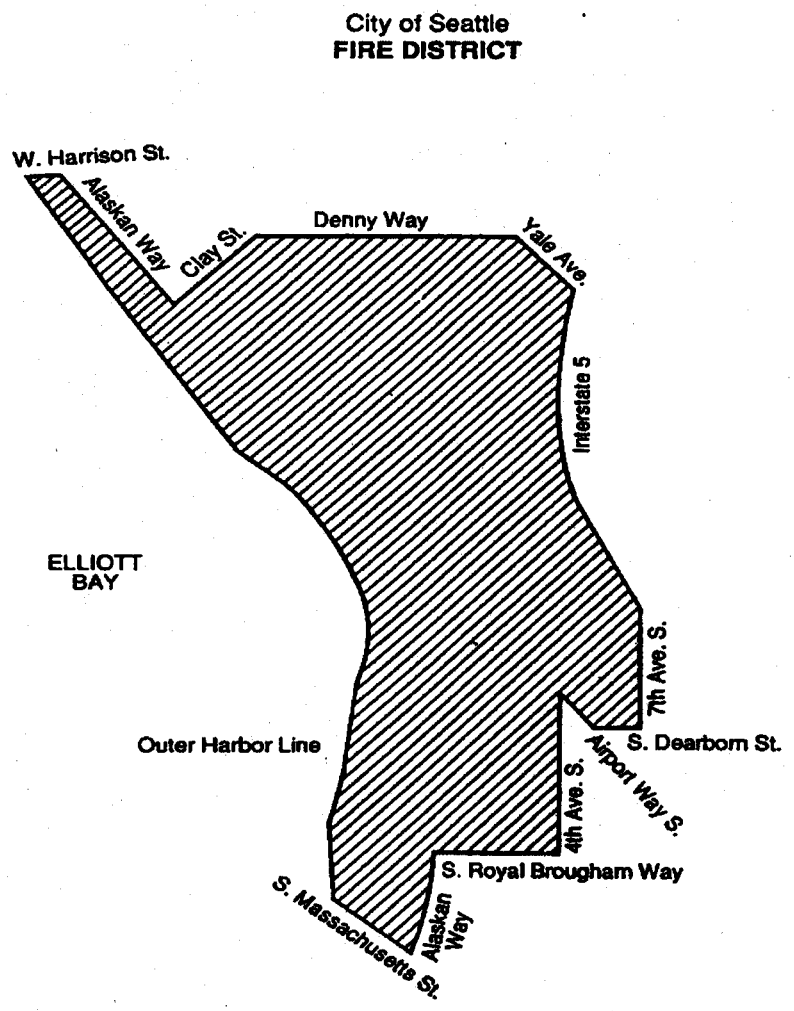

FIGURE 202F

[BF] FIRE DOOR. The door component of a *fire door assembly*.

[BF] FIRE DOOR ASSEMBLY. Any combination of a *fire door*, frame, hardware and other accessories that together provide a specific degree of fire protection to the opening.

FIRE DOOR ASSEMBLY, FLOOR. See "*Floor fire door assembly*."

[BF] FIRE EXIT HARDWARE. *Panic hardware* that is *listed* for use on *fire door assemblies*.

[F] FIRE LANE. A road or other passageway developed to allow the passage of fire apparatus. A fire lane is not necessarily intended for vehicular traffic other than fire apparatus.

[BF] FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

[BF] FIRE PROTECTION RATING. The period of time that an opening protective will maintain the ability to confine a fire as determined by tests specified in Section 716. Ratings are stated in hours or minutes.

[F] FIRE PROTECTION SYSTEM. *Approved* devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

[BF] FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, a bottom bar, guides, a coil, and an operating and closing system.

[BF] FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

[S] FIRE-RETARDANT COVERING. Material with a flame spread rating of less than 15 when tested in accordance with ASTM E84.

[F] FIRE SAFETY FUNCTIONS. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.

[S][BF] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. The closest interior *lot line*.
2. To the ((~~centerline~~)) opposite side of a street, an alley or *public way*.
3. To an imaginary line between two buildings on the lot.

The distance shall be measured at right angles from the face of the wall.

[S][BF] FIRE WALL. A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof. ((~~, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.~~))

[BF] FIRE WINDOW ASSEMBLY. A window constructed and glazed to give protection against the passage of fire.

[BF] FIREBLOCKING. Building materials, or materials *approved* for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

[M] FIREPLACE. A hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a chimney.

[BS] FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

[BF] FIRE-RATED GLAZING. Glazing with either a *fire protection rating* or a *fire-resistance rating*.

[BF] FIRE-RESISTANCE RATING. The period of time a *building element*, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

[BF] FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with either ASTM E1966 or UL 2079 to resist for a prescribed period of time the passage of fire through *joints* made in or between fire-resistance-rated assemblies.

[BS] FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

FIRESTOP, MEMBRANE-PENETRATION. See "*Membrane-penetration firestop*."

FIRESTOP, PENETRATION. See "*Penetration firestop*."

FIRESTOP SYSTEM, THROUGH-PENETRATION. See "*Through-penetration firestop system*."

[F] FIREWORKS. Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, *deflagration* or *detonation* that meets the definition of 1.4G fireworks or 1.3G fireworks.

Fireworks, 1.3G. Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, *deflagration* or *detonation*. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, UN0335 by the DOTn.

Fireworks, 1.4G. Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion or deflagration that complies with the construction, chemical composition and labeling regulations of the DOTn for fireworks, UN0336, and the US Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507.

[F] GAS DETECTION SYSTEM. A system or portion of a combination system that utilizes one or more stationary sensors to detect the presence of a specified gas at a specified concentration and initiate one or more responses required by this code, such as notifying a responsible person, activating an alarm signal, or activating or deactivating equipment. A self-contained gas detection and alarm device is not classified as a gas detection system.

[F] GAS ROOM. A separately ventilated, fully enclosed room in which only *compressed gases* and associated equipment and supplies are stored or *used*.

[F] GASEOUS HYDROGEN SYSTEM. An assembly of piping, devices and apparatus designed to generate, store, contain, distribute or transport a nontoxic, gaseous hydrogen-containing mixture having not less than 95-percent hydrogen gas by volume and not more than 1-percent oxygen by volume. Gaseous hydrogen systems consist of items such as *compressed gas* containers, reactors and appurtenances, including pressure regulators, pressure relief devices, manifolds, pumps, compressors and interconnecting piping and tubing and controls.

[BF] GLASS FIBERBOARD. Fibrous glass roof insulation consisting of inorganic glass fibers formed into rigid boards using a binder. The board has a top surface faced with asphalt and kraft reinforced with glass fiber.

[BS] GLASS MAT GYPSUM PANEL. A *gypsum panel* consisting of a noncombustible core primarily of gypsum, surfaced with glass mat partially or completely embedded in the core.

[BS] GRADE (LUMBER). The classification of lumber in regard to strength and utility in accordance with American Softwood Lumber Standard DOC PS 20 and the grading rules of an *approved* lumber rules-writing agency.

[BE] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An *emergency escape and rescue opening* located such that the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

[S][BG] GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at *exterior walls*. Where the finished ground level slopes away from the *exterior walls*, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building. For grade of structures built over water, see Section 425.3.

GRADE PLANE, STORY ABOVE. See "*Story above grade plane*."

[BE] GRANDSTAND. Tiered seating supported on a dedicated structural system and two or more rows high and is not a *building element* (see "*Bleachers*").

[BG] GREENHOUSE. A structure or thermally isolated area of a building that maintains a specialized sunlit environment used for and essential to the cultivation, protection or maintenance of plants.

[BG] GROSS LEASABLE AREA. The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating *gross leasable area*.

[BG] GROUP HOME. A facility for social rehabilitation, substance abuse or mental health problems that contains a group housing arrangement that provides *custodial care* but does not provide *medical care*.

[BE] GUARD. A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

[BG] GUESTROOM. A room used or intended to be used by one or more guests for living or sleeping purposes.

[BS] GYPSUM BOARD. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing.

[BS] GYPSUM PANEL PRODUCT. The general name for a family of sheet products consisting essentially of gypsum complying with the standards specified in Table 2506.2 and Table 2507.2, and Chapter 35. *Gypsum board* and *glass mat gypsum panels* are examples of *gypsum panel products*.

[BS] GYPSUM PLASTER. A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other *approved* materials as specified in this code.

[BS] GYPSUM SHEATHING. *Gypsum panel products* specifically manufactured with enhanced water resistance for use as a substrate for exterior surface materials.

[BS] GYPSUM VENEER PLASTER. *Gypsum plaster* applied to an *approved* base in one or more coats normally not exceeding 1/4 inch (6.4 mm) in total thickness.

[BS] GYPSUM WALLBOARD. A *gypsum board* used primarily as an interior surfacing for building structures.

[BG] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered *habitable spaces*.

[F] HALOGENATED EXTINGUISHING SYSTEM. A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

[F] HANDLING. The deliberate transport by any means to a point of storage or *use*.

[BE] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

[BS] HARDBOARD. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 pcf (497 kg/m^3).

HARDWARE. See "*Fire exit hardware*" and "*Panic hardware*."

[F] HAZARDOUS MATERIALS. Those chemicals or substances that are *physical hazards* or *health hazards* as classified in Section 307 and the *International Fire Code*, whether the materials are in usable or waste condition.

[F] HAZARDOUS PRODUCTION MATERIAL (HPM). A *solid*, *liquid* or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by NFPA 704 and which is *used* directly in research, laboratory or production processes which have as their end product materials that are not hazardous.

[BS] HEAD JOINT. Vertical *mortar joint* placed between *masonry units* within the *wythe* at the time the *masonry units* are laid.

[F] HEALTH HAZARD. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term "health hazard" includes chemicals that are *toxic* or *highly toxic*, and *corrosive*.

HEAT DETECTOR. See "*Detector, heat*."

[S][BG] HEIGHT, BUILDING. The vertical distance from *grade plane* to the average height of the highest roof surface other than rooftop structures complying with Section 1510.

[BS] HELICAL PILE. Manufactured steel *deep foundation* element consisting of a central shaft and one or more helical bearing plates. A *helical pile* is installed by rotating it into the ground. Each helical bearing plate is formed into a screw thread with a uniform defined pitch.

[F] HELIPAD. A structural surface that is used for the landing, taking off, taxiing and parking of helicopters.

[F] HELIPORT. An area of land or water or a structural surface that is used, or intended for use, for the landing and taking off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings or other heliport facilities.

[F] HELISTOP. The same as "heliport," except that no fueling, defueling, maintenance, repairs or storage of helicopters is permitted.

[F] HIGHER EDUCATION LABORATORY. Laboratories in Group B occupancies used for educational purposes above the 12th grade. Storage, use and handling of chemicals in such laboratories shall be limited to purposes related to testing, analysis, teaching, research or developmental activities on a nonproduction basis.

[F] HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as *highly toxic*. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

[BF] HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL). Panels consisting of layers of cellulose fibrous material impregnated with thermosetting resins and bonded together by a high-pressure process to form a homogeneous nonporous core suitable for exterior use.

[BF] HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL) SYSTEM. An *exterior wall covering* fabricated using HPL in a specific assembly including *joints*, seams, attachments, substrate, framing and other details as appropriate to a particular design.

[W][S][BG] HIGH-RISE BUILDING. A building with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. For the purposes of this definition, an occupied roof with an occupant load of 50 or more in a building that is equipped with an *automatic sprinkler system* and an occupant load of 10 or more in a building not equipped with an *automatic fire sprinkler system* are considered to be occupied floors.

[S][A] HISTORIC BUILDINGS. ((~~Any building or structure that is one or more of the following:~~)) See "Landmark."

((~~1. Listed or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.~~

~~2. Designated as historic under an applicable state or local law.~~

~~3. Certified as a contributing resource within a National Register, state designated or locally designated historic district.~~))

[BF] HORIZONTAL ASSEMBLY. A fire-resistance-rated floor or *roof assembly* of materials designed to restrict the spread of fire in which continuity is maintained.

[BE] HORIZONTAL EXIT. An *exit* component consisting of fire-resistance-rated construction and opening protectives intended to compartmentalize portions of a building thereby creating refuge areas that afford safety from the fire and smoke from the area of fire origin.

[W] HOSPICE CARE CENTER. A building or portion thereof used on a 24-hour basis for the provision of hospice services to terminally ill inpatients.

[BG] HOSPITALS AND PSYCHIATRIC HOSPITALS. Facilities that provide care or treatment for the medical, psychiatric, obstetrical, or surgical treatment of care recipients who are *incapable of self-preservation*.

[BG] HOUSING UNIT. A *dormitory* or a group of *cells* with a common dayroom in Group I-3.

HPM. See "*Hazardous Production Material*."

[F] HPM ROOM. A room used in conjunction with or serving a Group H-5 occupancy, where *HPM* is stored or *used* and which is classified as a Group H-2, H-3 or H-4 occupancy.

[BS] HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes defined as:

1. The US Atlantic Ocean and Gulf of Mexico coasts where the basic design wind speed, *V*, for Risk Category II buildings is greater than 115 mph (51.4 m/s);
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

[F] HYDROGEN FUEL GAS ROOM. A room or space that is intended exclusively to house a *gaseous hydrogen system*.

[BS] ICE-SENSITIVE STRUCTURE. A structure for which the effect of an atmospheric ice *load* governs the design of a structure or portion thereof. This includes, but is not limited to, lattice structures, guyed masts, overhead lines, light suspension and cable-stayed bridges, aerial cable systems (e.g., for ski lifts or logging operations), amusement rides, open catwalks and platforms, flagpoles and signs.

[F] IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of airborne contaminants which poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppmv/v) or milligrams per cubic meter (mg/m^3). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source *approved* by the *building official* shall make such determination.

[BS] IMPACT LOAD. The *load* resulting from moving machinery, elevators, craneways, vehicles and other similar forces and kinetic *loads*, pressure and possible surcharge from fixed or moving *loads*.

[BS] IMPACT PROTECTIVE SYSTEM. Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached or locked over exterior glazing.

[BG] INCAPABLE OF SELF-PRESERVATION. Persons who, because of age, physical limitations, mental limitations, chemical dependency or medical treatment, cannot respond as an individual to an emergency situation.

[F] INCOMPATIBLE MATERIALS. Materials that, when mixed, have the potential to react in a manner that generates heat, fumes, gases or byproducts which are hazardous to life or property.

[BS] INDIVIDUAL TRUSS MEMBER. A truss chord or truss web.

[F] INERT GAS. A gas that is capable of reacting with other materials only under abnormal conditions such as high temperatures, pressures and similar extrinsic physical forces. Within the context of the code, inert gases do not exhibit either physical or health hazard properties as defined (other than acting as a simple asphyxiant) or hazard properties other than those of a *compressed gas*. Some of the more common inert gases include argon, helium, krypton, neon, nitrogen and xenon.

[F] INITIATING DEVICE. A system component that originates transmission of a change-of-state condition, such as in a *smoke detector*, *manual fire alarm box* or supervisory switch.

[BF] INSULATING SHEATHING. A rigid panel or board insulation material having a thermal resistance of not less than R-2 of the core material with properties suitable for use on walls, floors, roofs or foundations.

[BE] INTENDED TO BE OCCUPIED AS A RESIDENCE. This refers to a *dwelling unit* or *sleeping unit* that can or will be used all or part of the time as the occupant's place of abode.

[BE] INTERIOR EXIT RAMP. An *exit* component that serves to meet one or more *means of egress* design requirements, such as required number of *exits* or *exit access* travel distance, and provides for a protected path of egress travel to the *exit discharge* or *public way*.

[BE] INTERIOR EXIT STAIRWAY. An *exit* component that serves to meet one or more *means of egress* design requirements, such as required number of *exits* or *exit access* travel distance, and provides for a protected path of egress travel to the *exit discharge* or *public way*.

[BF] INTERIOR FINISH. Interior finish includes *interior wall* and *ceiling finish* and *interior floor finish*.

[BF] INTERIOR FLOOR FINISH. The exposed floor surfaces of buildings including coverings applied over a finished floor or *stair*, including risers.

[BF] INTERIOR FLOOR-WALL BASE. *Interior floor finish trim* used to provide a functional or decorative border at the intersection of walls and floors.

[BF] INTERIOR SURFACES. Surfaces other than weather exposed surfaces.

[BF] INTERIOR WALL AND CEILING FINISH. The exposed *interior surfaces* of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including *trim*.

[BS] INTERLAYMENT. A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake *roof covering*.

[BS] INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

[BF] INTUMESCENT FIRE-RESISTANT COATINGS. Thin film liquid mixture applied to substrates by brush, roller, spray or trowel which expands into a protective foamed layer to provide fire-resistant protection of the substrates when exposed to flame or intense heat.

[BS] JOINT. The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

[S] ((~~[A] JURISDICTION.~~ ~~The governmental unit that has adopted this code.~~))

[BF] L RATING. The air leakage rating of a *through penetration firestop system* or a fire-resistant *joint* system when tested in accordance with UL 1479 or UL 2079, respectively.

[A] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material and the name and identification of an *approved agency*, and that indicates that the representative sample of the product or material has been tested and evaluated by an *approved agency* (see Section 1703.5, "*Manufacturer's designation*" and "*Mark*").

[A] LABELED. Equipment, materials or products to which has been affixed a *label*, seal, symbol or other identifying *mark* of a nationally recognized testing laboratory, *approved* agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

[F] LABORATORY SUITE. A fire-rated, enclosed laboratory area providing one or more laboratory spaces within a Group B educational occupancy that includes ancillary uses such as offices, bathrooms and corridors that are contiguous with the laboratory area, and are constructed in accordance with Section 428.

[S] LAND USE CODE. *Seattle Land Use Code*, Title 23 of the Seattle Municipal Code, as amended.

[S] LAND-DISTURBING ACTIVITY. Any activity that results in a movement of earth, or a change in the existing soil cover (both vegetative and nonvegetative) or the existing topography. Land-disturbing activities include, but are not limited to, clearing, grading, filling, excavation or addition or replacement of impervious surface.

[S] LANDMARK. A building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preser-

vation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a *landmark* or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

LEVEL OF EXIT DISCHARGE. See "*Exit discharge, level of*."

[F] LIFE SAFETY SYSTEMS. Systems, devices and equipment that enhance or facilitate evacuation, smoke control, compartmentation and isolation.

[BF] LIGHT-DIFFUSING SYSTEM. Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

[BS] LIGHT-FRAME CONSTRUCTION. Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

[BF] LIGHT-TRANSMITTING PLASTIC ROOF PANELS. Structural plastic panels other than *skylights* that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

[BF] LIGHT-TRANSMITTING PLASTIC WALL PANELS. Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in *exterior walls*.

[BS] LIMIT OF MODERATE WAVE ACTION. Line shown on FIRMs to indicate the inland limit of the 1-1/2-foot (457 mm) breaking wave height during the *base flood*.

[BS] LIMIT STATE. A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability *limit state*) or to be unsafe (strength *limit state*).

[W] LIMITED VERBAL OR PHYSICAL ASSISTANCE. Persons who, because of age, physical limitations, cognitive limitations, treatment or chemical dependency, and may not independently recognize, respond, or evacuate without limited verbal or physical assistance during an emergency situation. Verbal assistance includes prompting, giving, and repeating instructions. Physical assistance includes assistance with transfers to walking aids or mobility devices and assistance with egress.

[F] LIQUID. A material that has a melting point that is equal to or less than 68°F (20°C) and a *boiling point* that is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). When not otherwise identified, the term "liquid" includes both *flammable* and *combustible liquids*.

[F] LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of *flammable* or *combustible liquids* in a closed condition.

[F] LIQUID USE, DISPENSING AND MIXING ROOM. A room in which Class I, II and IIIA *flammable* or *combustible liquids* are *used*, dispensed or mixed in open containers.

[A] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *building official* and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

[BS] LIVE LOAD. A *load* produced by the use and occupancy of the building or other structure that does not include construction or environmental *loads* such as wind load, snow *load*, rain *load*, earthquake *load*, *flood load* or *dead load*.

[BS] LIVE LOAD, ROOF. A *load* on a roof produced:

1. During maintenance by workers, equipment and materials; or
2. During the life of the structure by movable objects such as planters or other similar small decorative appurtenances that are not occupancy related.

[BG] LIVE/WORK UNIT. A *dwelling unit* or *sleeping unit* in which a significant portion of the space includes a nonresidential use that is operated by the tenant.

[BS] LOAD AND RESISTANCE FACTOR DESIGN (LRFD). A method of proportioning structural members and their connections using load and *resistance factors* such that no applicable *limit state* is reached when the structure is subjected to appropriate load combinations. The term "LRFD" is used in the design of steel and wood structures.

[BS] LOAD EFFECTS. Forces and deformations produced in structural members by the applied *loads*.

[BS] LOAD FACTOR. A factor that accounts for deviations of the actual *load* from the *nominal load*, for uncertainties in the analysis that transforms the *load* into a *load effect*, and for the probability that more than one extreme *load* will occur simultaneously.

[BS] LOADS. Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement and restrained dimensional changes. Permanent *loads* are those *loads* in which variations over time are rare or of small magnitude, such as *dead loads*. All other *loads* are variable loads (see "*Nominal loads*").

[BG] LODGING HOUSE. A one-family dwelling where one or more occupants are primarily permanent in nature and rent is paid for guest rooms.

[W] LOFT. A space on an intermediate level or levels between the floor and ceiling of a Group R occupancy dwelling or sleeping unit, open on one or more sides to the room in which the loft is located, and in accordance with Section 420.14.

[A] LOT. A portion or parcel of land considered as a unit.

[A] LOT LINE. A line dividing one lot from another, or from a street or any public place.

[BE] LOW-ENERGY POWER-OPERATED DOOR. A swinging, sliding or folding door that opens automatically upon an action by a pedestrian such as pressing a push plate or waving a hand in front of a sensor. The door closes automatically, and operates with decreased forces and decreased speeds (see "*Power-assisted door*" and "*Power-operated door*").

[F] LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as "LEL" or "lower explosive limit."

[BS] LOWEST FLOOR. The *lowest floor* of the lowest enclosed area, including *basement*, but excluding any unfinished or flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of Section 1612.

[W] MAILBOXES. Receptacles for the receipt of documents, packages or other deliverable matter. *Mailboxes* include, but are not limited to, post office boxes and receptacles provided by commercial mail-receiving agencies, apartment houses and schools.

[BS] MAIN WINDFORCE-RESISTING SYSTEM. An assemblage of structural elements assigned to provide support and stability for the overall structure. The system generally receives wind loading from more than one surface.

MALL BUILDING, COVERED and MALL BUILDING, OPEN. See "*Covered mall building*."

[F] MANUAL FIRE ALARM BOX. A manually operated device used to initiate an *alarm signal*.

[A] MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see "*Label*" and "*Mark*").

[S] MARINA. A facility, generally on the waterfront, that stores and services boats in berths, on moorings, and in dry storage or dry stack storage.

[A] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see "*Label*" and "*Manufacturer's designation*").

[S][BG] MARQUEE. ((~~A *canopy* that has a top surface which is sloped less than 25 degrees from the horizontal and is located less than 10 feet (3048 mm) from operable openings above or adjacent to the level of the marquee.~~)) *Marquees* are a type of *canopy*. See "Canopy."

[BS] MASONRY. A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other *approved* units bonded together with or without *mortar* or grout or other accepted methods of joining.

Glass unit masonry. Masonry composed of glass units bonded by *mortar*.

Plain masonry. Masonry in which the tensile resistance of the masonry is taken into consideration and the effects of stresses in reinforcement are neglected.

Reinforced masonry. Masonry construction in which reinforcement acting in conjunction with the masonry is used to resist forces.

Solid masonry. Masonry consisting of solid *masonry units* laid contiguously with the *joints* between the units filled with *mortar*.

Unreinforced (plain) masonry. Masonry in which the tensile resistance of masonry is taken into consideration and the resistance of the reinforcing steel, if present, is neglected.

[BS] MASONRY UNIT. *Brick*, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103.

Hollow. A *masonry unit* whose net cross-sectional *area* in any plane parallel to the load-bearing surface is less than 75 percent of its gross cross-sectional *area* measured in the same plane.

Solid. A *masonry unit* whose net cross-sectional *area* in every plane parallel to the load-bearing surface is 75 percent or more of its gross cross-sectional *area* measured in the same plane.

[BG] MASS TIMBER. Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction.

[BF] MASTIC FIRE-RESISTANT COATINGS. Liquid mixture applied to a substrate by brush, roller, spray or trowel that provides fire-resistant protection of a substrate when exposed to flame or intense heat.

[BE] MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a *public way*. A *means of egress* consists of three separate and distinct parts: the *exit access*, the *exit* and the *exit discharge*.

[BF] MECHANICAL EQUIPMENT SCREEN. A rooftop structure, not covered by a roof, used to aesthetically conceal plumbing, electrical or mechanical equipment from view.

[BG] MECHANICAL-ACCESS ENCLOSED PARKING GARAGE. An enclosed parking garage that employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

[BG] MECHANICAL-ACCESS OPEN PARKING GARAGES. *Open parking garages* employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

[BG] MEDICAL CARE. Care involving medical or surgical procedures, nursing or for psychiatric purposes.

[BF] MEMBRANE PENETRATION. A breach in one side of a floor-ceiling, roof-ceiling or wall assembly to accommodate an item installed into or passing through the breach.

[BG] MEMBRANE-COVERED CABLE STRUCTURE. A nonpressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.

[BG] MEMBRANE-COVERED FRAME STRUCTURE. A nonpressurized building wherein the structure is composed of a rigid framework to support a tensioned membrane which provides the weather barrier.

[BF] MEMBRANE-PENETRATION FIRESTOP. A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

[BF] MEMBRANE-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly, one or more penetrating items installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time.

[BE] MERCHANDISE PAD. A merchandise pad is an area for display of merchandise surrounded by *aisles*, permanent fixtures or walls. Merchandise pads contain elements such as nonfixed and movable fixtures, cases, racks, counters and partitions as indicated in Section ((~~105.2~~)) 106.2 from which customers browse or shop.

[BF] METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a solid plastic core.

[BF] METAL COMPOSITE MATERIAL (MCM) SYSTEM. An *exterior wall covering* fabricated using MCM in a specific assembly including *joints*, seams, attachments, substrate, framing and other details as appropriate to a particular design.

[BS] METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m^2) per sheet.

[BS] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.279 m^2) per sheet.

[BG] MEZZANINE. An intermediate level or levels between the floor and ceiling of any *story* and in accordance with Section 505.

[BS] MICROPILE. A *micropile* is a bored, grouted-in-place *deep foundation* element that develops its load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock.

[BF] MINERAL BOARD. A rigid felted thermal insulation board consisting of either felted mineral fiber or cellular beads of expanded aggregate formed into flat rectangular units.

[BF] MINERAL FIBER. Insulation composed principally of fibers manufactured from rock, slag or glass, with or without binders.

[BF] MINERAL WOOL. Synthetic vitreous fiber insulation made by melting predominately igneous rock or furnace slag, and other inorganic materials, and then physically forming the melt into fibers.

[BS] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an *approved ballast* layer.

[BS] MORTAR. A mixture consisting of cementitious materials, fine aggregates, water, with or without admixtures, that is used to construct unit masonry assemblies.

[BS] MORTAR, SURFACE-BONDING. A mixture to bond concrete *masonry units* that contains hydraulic cement, glass fiber reinforcement with or without inorganic fillers or organic modifiers and water.

[BE] MULTILEVEL ASSEMBLY SEATING. Seating that is arranged in distinct levels where each level is composed of either multiple rows, or a single row of box seats accessed from a separate level.

[F] MULTIPLE-STATION ALARM DEVICE. Two or more single-station alarm devices that can be interconnected such that actuation of one causes all integral or separate audible alarms to operate. A multiple-station alarm device can consist of one single-station alarm device having connections to other detectors or to a *manual fire alarm box*.

[F] MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes the appropriate *alarm signal* to operate in all interconnected alarms.

[BE] MULTISTORY UNIT. A *dwelling unit* or *sleeping unit* with *habitable space* located on more than one story.

[BF] NAILABLE SUBSTRATE. A product or material such as framing, sheathing or furring, composed of wood, wood-based materials or other materials providing equivalent fastener withdrawal resistance.

[BS] NAILING, BOUNDARY. A special nailing pattern required by design at the boundaries of *diaphragms*.

[BS] NAILING, EDGE. A special nailing pattern required by design at the edges of each panel within the assembly of a *diaphragm* or *shear wall*.

[BS] NAILING, FIELD. Nailing required between the sheathing panels and framing members at locations other than *boundary nailing* and *edge nailing*.

[BS] NATURALLY DURABLE WOOD. The heartwood of the following species except for the occasional piece with corner sapwood, provided 90 percent or more of the width of each side on which it occurs is heartwood.

Decay resistant. Redwood, cedar, black locust and black walnut.

Termite resistant. Redwood, Alaska yellow cedar, Eastern red cedar and Western red cedar.

[W] NIGHTCLUB. An A-2 occupancy use in which the aggregate area of concentrated use of unfixed chairs and standing space that is specifically designated and primarily used for dancing or viewing performers exceeds 350 square feet, excluding adjacent lobby areas. "Nightclub" does not include theaters with fixed seating, banquet halls, or lodge halls.

[BS] NOMINAL LOADS. The magnitudes of the *loads* specified in Chapter 16 (dead, live, soil, wind, snow, rain, *flood* and earthquake).

[BS] NOMINAL SIZE (LUMBER). The commercial size designation of width and depth, in standard sawn lumber and glued-laminated lumber *grades*; somewhat larger than the standard net size of dressed lumber, in accordance with DOCPS 20 for sawn lumber and with the ANSI/AWC NDS for glued-laminated lumber.

[BG] NONCOMBUSTIBLE MEMBRANE STRUCTURE. A membrane structure in which the membrane and all component parts of the structure are noncombustible.

[BF] NONCOMBUSTIBLE PROTECTION (FOR MASS TIMBER). Noncombustible material, in accordance with Section 703.6, designed to increase the *fire-resistance rating* and delay the combustion of *mass timber*.

[S] NON-PRODUCTION LABORATORY FACILITY. A workplace facility where chemicals are used or synthesized on a non-production basis and the containers used for reactions, transfers, and other handling of chemicals are designed to be easily and safely manipulated by one person.

[BS] NONSTRUCTURAL CONCRETE. Any element made of plain or reinforced concrete that is not part of a structural system required to transfer either gravity or lateral *loads* to the ground.

[S] NONSTRUCTURAL TRIM. The moldings, battens, caps, nailing strips, latticing or cutouts which are attached to the *sign structure*.

[F] NORMAL TEMPERATURE AND PRESSURE (NTP). A temperature of 70°F (21°C) and a pressure of 1 atmosphere [14.7 psia (101 kPa)].

[BE] NOSING. The leading edge of treads of *stairs* and of landings at the top of *stairway flights*.

NOTIFICATION ZONE. See "*Zone, notification*."

[F] NUISANCE ALARM. An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

[BG] NURSING HOMES. Facilities that provide care, including both intermediate care facilities and skilled nursing facilities where any of the persons are *incapable of self-preservation*.

[BE] OCCUPANT LOAD. The number of persons for which the *means of egress* of a building or portion thereof is designed.

[BE] PANIC HARDWARE. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel. See "*Fire exit hardware*."

[BS] PARTICLEBOARD. A generic term for a panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers. The cellulosic material is combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

[BF] PENETRATION FIRESTOP. A *through-penetration* firestop or a *membrane-penetration firestop*.

[BG] PENTHOUSE. An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, *stairways*, and vertical *shaft* openings.

[BS] PERFORMANCE CATEGORY. A designation of *wood structural panels* as related to the panel performance used in Chapter 23.

[BF] PERIMETER FIRE CONTAINMENT SYSTEM. An assemblage of specific materials or products that is designed to resist for a prescribed period of time the passage of fire through voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies.

[BS] PERMANENT INDIVIDUAL TRUSS MEMBER DIAGONAL BRACING (PITMDB). Structural member or assembly intended to permanently stabilize the *PITMRs*.

[BS] PERMANENT INDIVIDUAL TRUSS MEMBER RESTRAINT (PITMR). Restraint that is used to prevent local buckling of an individual truss chord or web member because of the axial forces in the *individual truss member*.

[A] PERMIT. An official document or certificate issued by the *building official* that authorizes performance of a specified activity.

[S][A] PERSON. An individual, ((~~heirs, executors, administrators or assigns, and also includes a~~)) receiver, administrator, executor, assignee, trustee in bankruptcy, trust estate, firm, partnership, ((~~or~~)) joint venture, club, company, joint stock company, business trust, municipal corporation, political subdivision of the State of Washington, the State of Washington and any instrumentality thereof, corporation, ((~~its or their successors or assigns, or the agent of any of the aforesaid~~)) limited liability company, association, society or any group of individuals acting as a unit, whether mutual, cooperative, fraternal, nonprofit or otherwise, and the United States or any instrumentality thereof.

[BG] PERSONAL CARE SERVICE. The care of persons who do not require *medical care*. Personal care involves responsibility for the safety of the persons while inside the building

[BE] PHOTOLUMINESCENT. Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

[BS] PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight.

[BS] PHOTOVOLTAIC PANEL. A collection of modules mechanically fastened together, wired and designed to provide a field-installable unit.

[BS] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete *photovoltaic panels*, that converts solar radiation into electricity, including rack support systems.

[BS] PHOTOVOLTAIC SHINGLES. A *roof covering* resembling shingles that incorporates *photovoltaic modules*.

[F] PHYSICAL HAZARD. A chemical for which there is evidence that it is a *combustible liquid*, *cryogenic fluid*, *explosive*, flammable (*solid*, *liquid* or gas), *organic peroxide* (*solid* or *liquid*), *oxidizer* (*solid* or *liquid*), *oxidizing gas*, *pyrophoric* (*solid*, *liquid* or gas), *unstable (reactive) material* (*solid*, *liquid* or gas) or *water-reactive material* (*solid* or *liquid*).

[F] PHYSIOLOGICAL WARNING THRESHOLD LEVEL. A concentration of airborne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter (mg/m^3), that represents the concentration at which persons can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological response. When used in conjunction with the permissible exposure limit (PEL) the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of "*Permissible exposure limit (PEL)*" in the *International Fire Code*.

[S] PIER. A structure, usually of greater length than width, of timber, stone, concrete or other material, having a deck and projecting from the shore into waters so that boats may be moored alongside for loading, unloading, storage, repairs or commercial uses.

PLACE OF RELIGIOUS WORSHIP. See "*Religious worship, place of*."

[BF] PLASTIC COMPOSITE. A generic designation that refers to wood/plastic composites, plastic lumber and similar materials.

[BF] PLASTIC GLAZING. Plastic materials that are glazed or set in a frame or sash or are otherwise supported.

[BF] PLASTIC LUMBER. A manufactured product made primarily of plastic materials (filled or unfilled) which is generally rectangular in cross section.

[BG] PLATFORM. A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round *stages*; and similar purposes wherein, other than horizontal sliding curtains, there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

[BG] PLAY STRUCTURE. A structure composed of one or more components, where the user enters a play environment.

[BF] POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad *exterior walls* of buildings.

[BS] PORCELAIN TILE. Ceramic tile having an absorption of 0.5 percent or less in accordance with Table 10 of ANSI A137.1, or Tables 4 or 5 of ANSI A137.3.

[W] PORTABLE SCHOOL CLASSROOM. A prefabricated structure consisting of one or more rooms with direct exterior egress from the classroom(s). The structure is transportable in one or more sections and is designed to be used as an educational space with or without a permanent foundation. The structure shall be capable of being demounted and relocated to other locations as needs arise.

[BS] POSITIVE ROOF DRAINAGE. A design that accounts for deflections from all *design loads* and has sufficient additional slope to ensure that drainage of the roof occurs within 48 hours of precipitation.

[BE] POWER-ASSISTED DOOR. Swinging door which opens by reduced pushing or pulling force on the door-operating hardware. The door closes automatically after the pushing or pulling force is released and functions with decreased forces. See "*Low-energy power-operated door*" and "*Power-operated door*."

[BE] POWER-OPERATED DOOR. Swinging, sliding, or folding door which opens automatically when approached by a pedestrian or opens automatically upon an action by a pedestrian. The door closes automatically and includes provisions such as presence sensors to prevent entrapment. See "*Low energy power-operated door*" and "*Power-assisted door*."

[BS] PREFABRICATED WOOD I-JOIST. Structural member manufactured using sawn or *structural composite lumber* flanges and *wood structural panel* webs bonded together with exterior exposure adhesives, which forms an "I" cross-sectional shape.

[BS] PRESERVATIVE-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced susceptibility to damage by fungi, insects or marine borers.

[BS] PRESTRESSED MASONRY. *Masonry* in which internal stresses have been introduced to counteract potential tensile stresses in *masonry* resulting from applied *loads*.

[BG] PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. Members that are essential to the vertical stability of the *primary structural frame* under gravity loading.

[BG] PRIVATE GARAGE. A building or portion of a building in which motor vehicles used by the *owner* or tenants of the building or buildings on the premises are stored or kept, without provisions for repairing or servicing such vehicles for profit.

[S] PRIVATE TRANSFORMER VAULT. A vault that contains transformer equipment that is not owned by Seattle City Light or other electric power utility.

[S] PROJECTING SIGN. A sign other than a wall sign, which projects from and is supported by a wall of a building or structure.

[BG] PROSCENIUM WALL. The wall that separates the *stage* from the auditorium or assembly seating area.

PSYCHIATRIC HOSPITALS. See "*Hospitals and psychiatric hospitals*."

[BE] PUBLIC ENTRANCE. An entrance that is not a *service entrance* or a *restricted entrance*.

[A] PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

[BE] PUBLIC-USE AREAS. Interior or exterior rooms or spaces that are made available to the general public.

[BG] PUZZLE ROOM. A puzzle room is a type of *special amusement area* in which occupants are encouraged to solve a challenge to escape from a room or series of rooms.

[F] PYROPHORIC. A chemical with an auto-ignition temperature in air, at or below a temperature of 130°F (54.4°C).

[F] PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

[BF] RADIANT BARRIER. A material having a low-*emittance* surface of 0.1 or less installed in building assemblies.

[BE] RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5-percent slope).

RAMP, EXIT ACCESS. See "*Exit access ramp*."

RAMP, EXTERIOR EXIT. See "*Exterior exit ramp*."

RAMP, INTERIOR EXIT. See "*Interior exit ramp*."

[BG] RAMP-ACCESS OPEN PARKING GARAGES. *Open parking garages* employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

[A] RECORD DRAWINGS. Drawings ("as builts") that document the location of all devices, appliances, wiring sequences, wiring methods and connections of the components of a *fire alarm system* as installed.

[BF] REFLECTIVE PLASTIC CORE INSULATION. An insulation material packaged in rolls, that is less than 1/2 inch (12.7 mm) thick, with not less than one exterior low-*emittance* surface (0.1 or less) and a core material containing voids or cells.

[A] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or *jurisdiction* in which the project is to be constructed.

[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A *registered design professional* engaged by the owner or the owner's authorized agent to review and coordinate certain aspects of the project, as determined by the *building official*, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

[BG] RELIGIOUS WORSHIP, PLACE OF. A building or portion thereof intended for the performance of religious services.

[A] RELOCATABLE BUILDING. A partially or completely assembled building constructed and designed to be reused multiple times and transported to different building sites.

[A] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

[S][BG] REPAIR GARAGE. ((~~A building, structure or portion thereof used for servicing or repairing motor vehicles.~~))

Major repair garage. A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, and repairs that require draining of the motor vehicle fuel tank are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms.

Minor repair garage. A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air conditioning refrigerants, etc.), brake system repairs, tire rotation, and similar routine maintenance work, including associated floor space used for offices, parking, or showrooms.

[BS] REROOFING. The process of recovering or replacing an existing *roof covering*. See "*Roof recover*" and "*Roof replacement*."

[BG] RESIDENTIAL AIRCRAFT HANGAR. An accessory building less than 2,000 square feet (186 m^2) and 20 feet (6096 mm) in *building height* constructed on a one- or two-family property where aircraft are stored. Such use will be considered as a residential accessory use incidental to the dwelling.

[W] RESIDENTIAL SLEEPING SUITES. A unit that provides multiple rooms or spaces for up to five residents, includes provisions for sleeping and can include provisions for living, eating, sanitation, and kitchen facilities.

[BS] RESISTANCE FACTOR. A factor that accounts for deviations of the actual strength from the *nominal strength* and the manner and consequences of failure (also called "strength reduction factor").

[BE] RESTRICTED ENTRANCE. An entrance that is made available for common use on a controlled basis, but not public use, and that is not a *service entrance*.

[S] ((~~[BG] RETRACTABLE AWNING.~~ ~~A retractable *awning* is a cover with a frame that retracts against a building or other structure to which it is entirely supported.~~))

[BS] RISK CATEGORY. A categorization of buildings and *other structures* for determination of *flood*, wind, snow, ice and earthquake *loads* based on the risk associated with unacceptable performance.

[BS] RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS. The most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk.

[BS] ROOF ASSEMBLY (For application to Chapter 15 only). A system designed to provide weather protection and resistance to design *loads*. The system consists of a *roof covering* and roof deck or a single component serving as both the *roof covering* and the roof deck. A roof assembly can include an *underlayment*, a thermal barrier, insulation or a *vapor retarder*.

[BS] ROOF COATING. A fluid-applied, adhered coating used for roof maintenance or *roof repair*, or as a component of a *roof covering* system or *roof assembly*.

[BS] ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See "*Roof assembly*."

[BS] ROOF DECK. The flat or sloped surface constructed on top of the *exterior walls* of a building or other supports for the purpose of enclosing the *story* below, or sheltering an area, to protect it from the elements, not including its supporting members or vertical supports.

ROOF DRAINAGE, POSITIVE. See "*Positive roof drainage*."

[BS] ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing *roof covering* without removing the existing *roof covering*.

[BS] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of correcting damage or restoring pre-damage condition.

[BS] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

[S] ROOF SIGN. A sign erected upon or above a roof or parapet of a building or structure.

[BG] ROOF VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, *attics*, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

[BG] ROOFTOP STRUCTURE. A structure erected on top of the roof deck or on top of any part of a building.

[BS] RUNNING BOND. The placement of *masonry units* such that *head joints* in successive courses are horizontally offset at least one-quarter the unit length.

[BG] SALLYPORT. A security vestibule with two or more doors or gates where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door or gate at a time.

[BE] SCISSOR STAIRWAY. Two interlocking *stairways* providing two separate paths of egress located within one *exit* enclosure.

[BS] SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

[S][BG] SECONDARY STRUCTURAL MEMBERS. The following structural members shall be considered secondary members and not part of the *primary structural frame*:

1. Structural members not having direct connections to the columns.
2. Members of the floor construction and roof construction not having direct connections to the columns.
3. Bracing members that are not designated as part of a *primary structural frame* or bearing wall.

Interpretation I202S: A *secondary member* (component or subsystem) is a structurally significant portion of the building that is supported by the *primary structural frame*, but which does not contribute to the strength or stability of the primary structure. *Secondary members* have internal structural integrity to perform their function and have their interactions with and attachments to, the *primary structural frame* analyzed and designed to assure proper integration within the total structure.

[BS] SEISMIC DESIGN CATEGORY. A classification assigned to a structure based on its *risk category* and the severity of the *design earthquake ground motion* at the site.

[BS] SEISMIC FORCE-RESISTING SYSTEM. That part of the structural system that has been considered in the design to provide the required resistance to the prescribed seismic forces.

[BF] SELF-CLOSING. As applied to a *fire door* or other opening protective, means equipped with an device that will ensure closing after having been opened.

[BE] SELF-LUMINOUS. Illuminated by a self-contained power source, other than batteries, and operated independently of external power sources.

SELF-PRESERVATION, INCAPABLE OF. See "*Incapable of self-preservation*."

[BG] SELF-SERVICE STORAGE FACILITY. Real property designed and used for the purpose of renting or leasing individual storage spaces to customers for the purpose of storing and removing personal property on a self-service basis.

[F] SERVICE CORRIDOR. A fully enclosed passage used for transporting *HPM* and purposes other than required *means of egress*.

[BE] SERVICE ENTRANCE. An entrance intended primarily for delivery of goods or services.

[BF] SHAFT. An enclosed space extending through one or more *stories* of a building, connecting vertical openings in successive floors, or floors and roof.

[BF] SHAFT ENCLOSURE. The walls or construction forming the boundaries of a *shaft*.

[BS] SHALLOW FOUNDATION. A *shallow foundation* is an individual or strip footing, a mat foundation, a slab-on-grade foundation or a similar foundation element.

[BS] SHEAR WALL. This definition applies only to Chapter 23.

A wall designed to resist lateral forces parallel to the plane of a wall.

Shear wall, perforated. A *wood structural panel* sheathed wall with openings, that has not been specifically designed and detailed for force transfer around openings.

Shear wall segment, perforated. A section of shear wall with full-height sheathing that meets the height-to-width ratio limits of Section 4.3.4 of AWC SDPWS.

[BS] SHINGLE FASHION. A method of installing roof or wall coverings, *water-resistive barriers,* flashing or other building components such that upper layers of material are placed overlapping lower layers of material to provide for drainage via gravity and moisture control.

[S] SIGN STRUCTURE. Any structure which supports or is designed to support any sign *display surface*.

[BS] SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

[F] SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

[BG] SITE. A parcel of land bounded by a *lot line* or a designated portion of a public right-of-way.

[BS] SITE CLASS. A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.2.2.

[BS] SITE COEFFICIENTS. The values of F_a and F_v indicated in Table 1613.2.3(1) and Table 1613.2.3(2), respectively.

[BG] SITE-FABRICATED STRETCH SYSTEM. A system, fabricated on site and intended for acoustical, tackable or aesthetic purposes, that is composed of three elements:

1. A frame (constructed of plastic, wood, metal or other material) used to hold fabric in place.
2. A core material (infill, with the correct properties for the application).
3. An outside layer, composed of a textile, fabric or vinyl, that is stretched taut and held in place by tension or mechanical fasteners via the frame.

[BS] SKYLIGHT, UNIT. A factory-assembled, glazed *fenestration* unit, containing one panel of glazing material that allows for natural lighting through an opening in the *roof assembly* while preserving the weather-resistant barrier of the roof.

[BS] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. *Unit skylights*, *tubular daylighting devices*, glazing materials, solariums, *sunrooms*, roofs and sloped walls are included in this definition.

[A] SLEEPING UNIT. A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

[S] SLIP. A berthing space between or adjacent to *piers*, wharves, or docks; the water areas associated with boat moorage.

[W] SMALL BUSINESS. Any business entity (including a sole proprietorship, corporation, partnership or other legal entity) which is owned and operated independently from all other businesses, which has the purpose of making a profit, and which has 50 or fewer employees.

[F] SMOKE ALARM. A single- or multiple-station alarm responsive to smoke. See "*Multiple-station smoke alarm*" and "*Single-station smoke alarm*."

[BF] SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

[BG] SMOKE COMPARTMENT. A space within a building separated from other interior areas of the building by *smoke barriers*, including interior walls and *horizontal assemblies*.

[BF] SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a *fire command center*.

[F] SMOKE DETECTOR. A *listed* device that senses visible or invisible particles of combustion.

[BF] SMOKE PARTITION. A wall assembly that extends from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

[BF] SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84.

[S] ((~~[BF] SMOKEPROOF ENCLOSURE.~~ ~~An *exit stairway* or *ramp* designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.~~))

[BE] SMOKE-PROTECTED ASSEMBLY SEATING. Seating served by *means of egress* that is not subject to smoke accumulation within or under a structure for a specified design time by means of passive design or by mechanical ventilation.

[BG] SOFT CONTAINED PLAY EQUIPMENT STRUCTURE. A play structure containing one or more components where the user enters a play environment that utilizes pliable materials.

[F] SOLID. A material that has a melting point, decomposes or sublimes at a temperature greater than 68°F (20°C).

[BG] SPECIAL AMUSEMENT AREA. A special amusement area is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and is arranged in a manner that:

1. Makes the means of egress path not readily apparent due to visual or audio distractions.
2. Intentionally confounds identification of the means of egress path.
3. Otherwise makes the means of egress path not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

[BG] SPECIAL EVENT STRUCTURE. Any ground-supported structure, *platform*, *stage*, *stage* scaffolding or rigging, canopy, tower or similar structure supporting entertainment-related equipment or signage.

[BS] SPECIAL FLOOD HAZARD AREA. The land area subject to flood hazards and shown on a *Flood Insurance Rate Map* or other flood hazard map as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

[BS] SPECIAL INSPECTION. Inspection of construction requiring the expertise of an *approved special inspector* in order to ensure compliance with this code and the approved *construction documents*.

Continuous special inspection. *Special inspection* by the *special inspector* who is present continuously when and where the work to be inspected is being performed.

Periodic special inspection. *Special inspection* by the *special inspector* who is intermittently present where the work to be inspected has been or is being performed.

[BS] SPECIAL INSPECTOR. A qualified person employed or retained by an *approved* agency and *approved* by the *building official* as having the competence necessary to inspect a particular type of construction requiring *special inspection*.

[BS] SPECIFIED COMPRESSIVE STRENGTH OF MASONRY, f'_m. Minimum compressive strength, expressed as force per unit of net cross-sectional area, required of the *masonry* used in construction by the *approved construction documents*, and upon which the project design is based. Whenever the quantity f'_m is under the radical sign, the square root of numerical value only is intended and the result has units of pounds per square inch (psi) (MPa).

[BF] SPLICE. The result of a factory and/or field method of joining or connecting two or more lengths of a *fire-resistant joint system* into a continuous entity.

SPORT ACTIVITY, AREA OF. See "*Area of sport activity*."

[F] SPRAY ROOM. A room designed to accommodate spraying operations.

[BF] SPRAY-APPLIED FOAM PLASTIC. Single- and multiple-component, spray-applied foam plastic insulation used in nonstructural applications that are installed at locations wherein the material is applied in a liquid or frothed state, permitted to free rise and cure in situ.

[BF] SPRAYED FIRE-RESISTANT MATERIALS. Cementitious or fibrous materials that are sprayed to provide fire-resistant protection of the substrates.

[BG] STAGE. A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.

[W] STAGED EVACUATION. A method of emergency response that engages building components and trained staff to provide occupant safety during an emergency. Emergency response involves moving or holding certain occupants at temporary locations for a brief period of time before evacuating the building. This response is used by ambulatory surgery facility and *assisted living facilities* to protect the health and safety of fragile occupants and residents.

[BE] STAIR. A change in elevation, consisting of one or more risers.

[BE] STAIRWAY. One or more *flights* of *stairs*, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

STAIRWAY, EXIT ACCESS. See "*Exit access stairway*."

STAIRWAY, EXTERIOR EXIT. See "*Exterior exit stairway*."

STAIRWAY, INTERIOR EXIT. See "*Interior exit stairway*."

STAIRWAY, SCISSOR. See "*Scissor stairway*."

[BE] STAIRWAY, SPIRAL. A *stairway* having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

~~((**[F] STANDBY POWER SYSTEM.** A source of *automatic* electric power of a required capacity and duration to operate required building, *hazardous materials* or *ventilation* systems in the event of a failure of the primary power. Standby power systems are required for electrical loads where interruption of the primary power could create hazards or hamper rescue or fire-fighting operations.))~~

[S] STANDBY POWER SYSTEM, LEGALLY REQUIRED. An electrical power system that complies with *Seattle Electrical Code* Article 701, Legally Required Standby Systems, and Chapter 27.

[F] STANDPIPE, TYPES OF. Standpipe types are as follows:

Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as dry pipe valve, to admit water into the system piping *automatically* upon the opening of a hose valve. The water supply for an *automatic* dry standpipe system shall be capable of supplying the system demand.

Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand *automatically*.

Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to meet the system demand.

Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to meet the system demand.

Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

[F] STANDPIPE SYSTEM, CLASSES OF. Standpipe classes are as follows:

Class I system. A system providing 2-1/2-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

Class II system. A system providing 1-1/2-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Class III system. A system providing 1-1/2-inch (38 mm) hose stations to supply water for use by building occupants and 2-1/2-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

[BS] STEEL CONSTRUCTION, COLD-FORMED. That type of construction made up entirely or in part of *steel structural members* cold formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

[BS] STEEL ELEMENT, STRUCTURAL. Any *steel structural member* of a building or structure consisting of rolled shapes, pipe, hollow structural sections, plates, bars, sheets, rods or steel castings other than cold-formed steel or *steel joist* members.

[BS] STEEL JOIST. Any *steel structural member* of a building or structure made of hot-rolled or cold-formed solid or open-web sections, or riveted or welded bars, strip or sheet steel members, or slotted and expanded, or otherwise deformed rolled sections.

[BF] STEEP SLOPE. A roof slope 2 units vertical in 12 units horizontal (17-percent slope) or greater.

[BS] STONE MASONRY. *Masonry* composed of field, quarried or *cast stone* units bonded by *mortar*.

[F] STORAGE, HAZARDOUS MATERIALS. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

[BS] STORAGE RACKS, STEEL. Cold-formed or hot-rolled steel structural members which are formed into *steel storage racks*, including pallet storage racks, movable-shelf racks, rack-supported systems, automated storage and retrieval systems (stacker racks), push-back racks, pallet-flow racks, case-flow racks, pick modules and rack-supported platforms. Other types of racks, such as drive-in or drive-through racks, cantilever racks, portable racks or racks made of materials other than steel, are not considered storage racks for the purpose of this code.

[BS] STORAGE RACKS, STEEL CANTILEVERED. A framework or assemblage composed of cold-formed or hot-rolled steel structural members, primarily in the form of vertical columns, extended bases, horizontal arms projecting from the faces of the columns, and longitudinal (down-aisle) bracing between columns. There may be shelf beams between the arms, depending on the products being stored; this definition does not include other types of racks such as pallet storage racks, drive-in racks, drive-through racks, or racks made of materials other than steel.

[BG] STORM SHELTER. A building, structure or portions thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

Community storm shelter. A storm shelter not defined as a "Residential storm shelter."

Residential storm shelter. A storm shelter serving occupants of *dwelling units* and having an *occupant load* not exceeding 16 persons.

[S][BG] STORY. That portion of a building, ((~~included~~)) including basements, located between the upper surface of a floor and the upper surface of the next floor or roof ((~~next~~)) above (see "*Basement*," "*Building height*," "*Grade plane*" and "*Mezzanine*"). A story is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

[S][BG] STORY ABOVE GRADE PLANE. Any *story* having its finished floor surface entirely above *grade plane*, or in which the finished surface of the next floor ((~~next~~)) above is:

1. More than 6 feet (1829 mm) above *grade plane*; or
2. More than 12 feet (3658 mm) above the finished ground level ((~~at any point~~)) for more than 25 feet (7620 mm) of the perimeter. Required driveways up to 22 feet (6706 mm) wide shall not be considered in calculating the 25-foot distance if there is at least 10 feet (3048 mm) between the driveway and all portions of the 25-foot area. See Figure 202S.

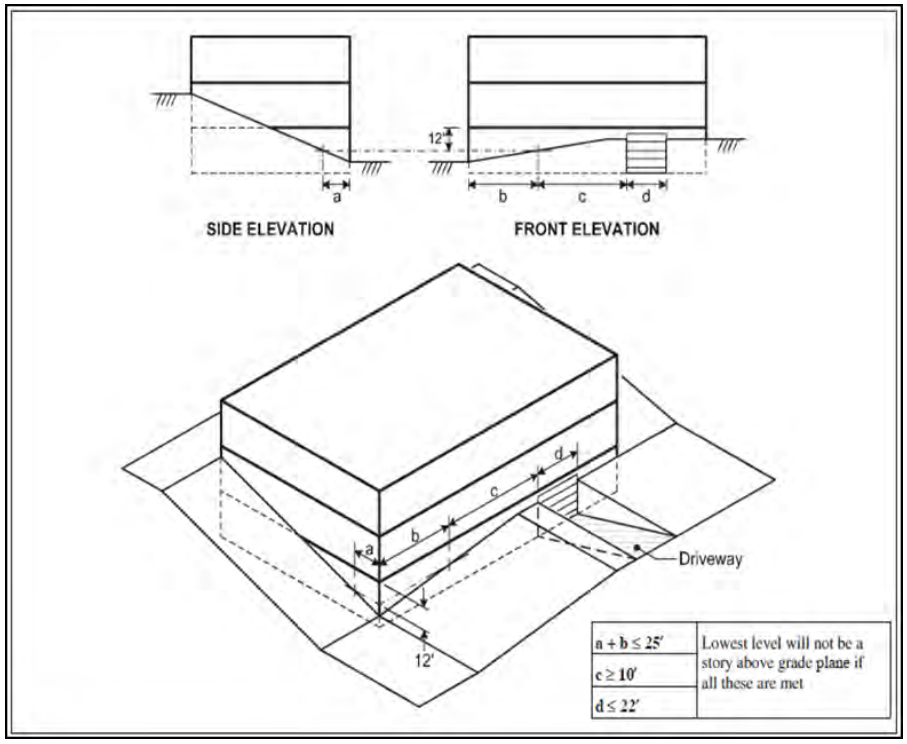

FIGURE 202S
STORY ABOVE GRADE PLANE

[BS] STRENGTH. This term is defined two ways, the first for use in Chapter 16 and the second for use in Chapter 21.

For Chapter 16:

Nominal strength. The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and equations derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

Required strength. Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

Strength design. A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength [also called "load and resistance factor design" (LRFD)]. The term "strength design" is used in the design of concrete and masonry structural elements.

For Chapter 21:

Design strength. Nominal strength multiplied by a strength reduction factor.

Nominal strength. Strength of a member or cross section calculated in accordance with these provisions before application of any strength-reduction factors.

Required strength. Strength of a member or cross section required to resist factored loads.

[BS] STRUCTURAL COMPOSITE LUMBER. Structural member manufactured using wood elements bonded together with exterior adhesives. Examples of *structural composite lumber* are:

Laminated strand lumber (LSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths not less than 150 times the least dimension of the wood strand elements.

Laminated veneer lumber (LVL). A composite of wood *veneer* sheet elements with wood fibers primarily oriented along the length of the member, where the *veneer* element thicknesses are 0.25 inches (6.4 mm) or less.

Oriented strand lumber (OSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inches (2.54 mm) or less and their average lengths not less than 75 times and less than 150 times the least dimension of the strand elements.

Parallel strand lumber (PSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member where the least dimension of the wood strand elements is 0.25 inches (6.4 mm) or less and their average lengths not less than 300 times the least dimension of the wood strand elements.

[S] STRUCTURAL ENGINEER IN RESPONSIBLE CHARGE. A structural engineer licensed to practice under the laws of the State of Washington who is engaged by the owner to review and coordinate structural design aspects of the project, as determined by the *building official*, for compatibility with the design of the building or structure, including submittal documents prepared by others, *deferred submittal* documents and phased submittal documents.

[BS] STRUCTURAL GLUED-LAMINATED TIMBER. An engineered, stress-rated product of a timber laminating plant, composed of assemblies of specially selected and prepared wood laminations in which the grain of all laminations is approximately parallel longitudinally and the laminations are bonded with adhesives.

[BS] STRUCTURAL OBSERVATION. The visual observation of the structural system by a *registered design professional* for general conformance to the *approved construction documents*.

[S] STRUCTURALLY QUALIFIED PRODUCTS. Products that have been prequalified based on current acceptance and certification by an accepted authority such as International Code Council (ICC), American Society for Testing and Materials (ASTM), American Concrete Institute (ACI), American Institute of Steel Construction (AISC), or others widely accepted in the engineering field.

[A] STRUCTURE. That which is built or constructed.

[BS] SUBSTANTIAL DAMAGE. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[S][BS] SUBSTANTIAL IMPROVEMENT. Any *repair*, reconstruction, rehabilitation, *alteration*, *addition* or other improvement of a building or structure, the cost of which, in any five-year period, equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained *substantial damage*, any repairs are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the *building official* and that are the minimum necessary to assure safe living conditions.
2. Any *alteration* of a historic structure provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

[S] SUBSTRUCTURE. The portion of the construction below and including the deck immediately above the water.

[BG] SUNROOM. A one-*story* structure attached to a building with a glazing area in excess of 40 percent of the gross area of the structure's *exterior walls* and roof.

[S] SUPERSTRUCTURE. The portion of construction above the deck.

Exception: *Covered boat moorage.*

[F] SUPERVISING STATION. A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

[F] SUPERVISORY SERVICE. The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

[F] SUPERVISORY SIGNAL. A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

[F] SUPERVISORY SIGNAL-INITIATING DEVICE. An initiation device, such as a valve supervisory switch, water-level indicator or low-air pressure switch on a dry-pipe sprinkler system, whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system, or a need for action in connection with guard tours, fire suppression systems or equipment or maintenance features of related systems.

[BS] SUSCEPTIBLE BAY. A roof or portion thereof with either of the following:

1. A slope less than 1/4-inch per foot (0.0208 rad).
2. On which water is impounded, in whole or in part, and the secondary drainage system is functional but the primary drainage system is blocked.

A roof surface with a slope of 1/4-inch per foot (0.0208 rad) or greater towards points of free drainage is not a susceptible bay.

[BG] SWIMMING POOL. Any structure intended for swimming, recreational bathing or wading that contains water over 24 inches (610 mm) deep. This includes in-ground, above-ground and on-ground pools; hot tubs; spas and fixed-in-place wading pools.

[BF] T RATING. The time period that the *penetration firestop system*, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E814 or UL 1479.

[BG] TECHNICAL PRODUCTION AREA. Open elevated areas or spaces intended for entertainment technicians to walk on and occupy for servicing and operating entertainment technology systems and equipment. Galleries, including fly and lighting galleries, gridirons, catwalks, and similar areas are designed for these purposes.

[BG] TENSILE MEMBRANE STRUCTURE. A membrane structure having a shape that is determined by tension in the membrane and the geometry of the support structure. Typically, the structure consists of both flexible elements (e.g., membrane and cables), nonflexible elements (e.g., struts, masts, beams and arches) and the anchorage (e.g., supports and foundations). This includes frame-supported *tensile membrane structures*.

[F] TENT. A structure, enclosure, *umbrella structure* or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported in any manner except by air or the contents it protects (see "*Umbrella structure*").

[BF] TERMINATED STOPS. Factory feature of a door frame where the stops of the door frame are terminated not more than 6 inches (152 mm) from the bottom of the door frame. Terminated stops are also known as "hospital stops" or "sanitary stops."

[BG] THERMAL ISOLATION. A separation of conditioned spaces, between a *sunroom* and a *dwelling unit*, consisting of existing or new walls, doors or windows.

[BF] THERMOPLASTIC MATERIAL. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

[BF] THERMOSETTING MATERIAL. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

[BF] THROUGH PENETRATION. A breach in both sides of a floor, floor-ceiling or wall assembly to accommodate an item passing through the breaches.

[BF] THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor, floor-ceiling, or wall assembly, one or more penetrating items passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time.

[BS] TIE, WALL. Metal connector that connects *wythes* of *masonry* walls together.

[BS] TIE-DOWN (HOLD-DOWN). A device used to resist uplift of the chords of *shear walls*.

[BS] TILE, STRUCTURAL CLAY. A hollow *masonry unit* composed of burned clay, shale, fire clay or mixture thereof, and having parallel cells.

[F] TIRES, BULK STORAGE OF. Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m^3).

[S][A] TOWNHOUSE. A ((~~single-family *dwelling unit* constructed in a group of~~)) *building* that contains three or more attached townhouse units. ((~~in which each unit extends from the foundation to roof and with open space on at least two sides.~~))

[S] TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and that has a yard or public way on not less than two sides that extends at least 50 percent of the length of each of these two sides.

[F] TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram, but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million, but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

[BG] TRANSIENT. Occupancy of a *dwelling unit* or *sleeping unit* for not more than 30 days.

[BG] TRANSIENT AIRCRAFT. Aircraft based at another location and that is at the transient location for not more than 90 days.

[W] TRANSIENT LODGING. A building, facility or portion thereof, excluding inpatient medical care facilities and long-term care facilities, that contains one or more *dwelling units* or sleeping units. Examples of *transient lodging* include, but are not limited to, resorts, group homes, hotels, motels, dormitories, homeless shelters, halfway houses and social service lodging.

TREATED WOOD. See *"Fire-retardant-treated wood"* and *"Preservative-treated wood."*

[BF] TRIM. Picture molds, chair rails, baseboards, *handrails*, door and window frames and similar decorative or protective materials used in fixed applications.

[F] TROUBLE SIGNAL. A signal initiated by the *fire alarm system* or device indicative of a fault in a monitored circuit or component.

[BS] TSUNAMI DESIGN GEODATABASE. The ASCE database (version 2016-1.0) of *Tsunami Design Zone* maps and associated design data for the states of Alaska, California, Hawaii, Oregon and Washington.

[BS] TSUNAMI DESIGN ZONE. An area identified on the *Tsunami Design Zone* map between the shoreline and the inundation limit, within which certain structures designated in Chapter 16 are designed for or protected from inundation.

[BS] TUBULAR DAYLIGHTING DEVICE (TDD). A non-operable *fenestration* unit primarily designed to transmit daylight from a roof surface to an interior ceiling via a tubular conduit. The basic unit consists of an exterior glazed weathering surface, a light-transmitting tube with a reflective interior surface, and an interior-sealing device such as a translucent ceiling panel. The unit can be factory assembled, or field-assembled from a manufactured kit.

[BE] TYPE A UNIT. A *dwelling unit* or *sleeping unit* designed and constructed for accessibility in accordance with this code and the provisions for *Type A units* in ICC A117.1.

[BE] TYPE B UNIT. A *dwelling unit* or *sleeping unit* designed and constructed for accessibility in accordance with this code and the provisions for *Type B units* in ICC A117.1, consistent with the design and construction requirements of the federal Fair Housing Act.

[F] UMBRELLA STRUCTURE. A structure, enclosure or shelter with or without sidewalls or drops, constructed of fabric or pliable material supported by a central pole or poles (see "*Tent*").

[BS] UNDERLAYMENT. One or more layers of a material that is applied to a steep-slope *roof covering* deck under the *roof covering* and resists liquid water that penetrates the *roof covering*.

[BS] UNDERPINNING. The alteration of an existing foundation to transfer *loads* to a lower elevation using new piers, piles or other permanent structural support elements installed below the existing foundation.

UNIT SKYLIGHT. See "*Skylight, unit*."

[S] UNSAFE. Structurally unsound, provided with inadequate egress, constituting a fire hazard, or otherwise dangerous to human life, or constituting a hazard to safety, health or public welfare.

[F] UNSTABLE (REACTIVE) MATERIAL. A material, other than an *explosive*, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including *explosion*, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with *incompatible materials*. Unstable (reactive) materials are subdivided as follows:

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at *normal temperatures and pressures*, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 3. Materials that in themselves are capable of *detonation* or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 4. Materials that in themselves are readily capable of *detonation* or *explosive* decomposition or explosive reaction at *normal temperatures and pressures*. This class includes materials that are sensitive to mechanical or localized thermal shock at *normal temperatures and pressures*.

[S][F] USE (MATERIAL). Placing a material into action, including *solids*, *liquids* and gases.

Interpretation I202U: Use, where otherwise mentioned in this code, is equivalent to character of occupancy and not intended to be construed as the definition of "use" in the *Land Use Code*.

[S] UTILITY TRANSFORMER VAULT. A vault containing transformer equipment owned by Seattle City Light or other electric power utility.

[BG] VAPOR DIFFUSION PORT. An assembly constructed or installed within a roof assembly at an opening in the roof deck to convey water vapor from an unvented *attic* to the outside atmosphere.

[BF] VAPOR PERMEABLE. The property of having a moisture vapor permeance rating of 5 perms (2.9×10^{-10} kg/Pa × s × m^2) or greater, when tested in accordance with Procedure A or Procedure B of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

3. Ceiling and roof soffits located a minimum horizontal distance of 10 feet (3048 mm) from the outer edges of the ceiling or roof soffits.

[F] WET-CHEMICAL EXTINGUISHING SYSTEM. A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

[S] WHARF. A structure or bulkhead constructed of wood, stone, concrete or similar material built at the shore of a harbor, lake or river for vessels to lie alongside of, and to anchor *piers* or floats.

[BE] WHEELCHAIR SPACE. A space for a single wheelchair and its occupant.

[BS] WIND SPEED, *V*. Basic design wind speeds.

[BS] WIND SPEED, V_{asd}. *Allowable stress design* wind speeds.

[BS] WINDBORNE DEBRIS REGION. Areas within *hurricane-prone regions* located:

1. Within 1 mile (1.61 km) of the mean high-water line where an Exposure D condition exists upwind at the waterline and the basic design wind speed, *V*, is 130 mph (58 m/s) or greater; or
2. In areas where the basic design wind speed is 140 mph (63 m/s) or greater.

For *Risk Category* II buildings and structures and Risk Category III buildings and structures, except health care facilities, the windborne debris region shall be based on Figure 1609.3.(1). For *Risk Category* IV buildings and structures and *Risk Category* III health care facilities, the windborne debris region shall be based on Figure 1609.3(2).

[BE] WINDER. A tread with nonparallel edges.

WINDFORCE-RESISTING SYSTEM, MAIN. See "*Main windforce-resisting system*."

[BS] WIRE BACKING. Horizontal strands of tautened wire attached to surfaces of vertical supports which, when covered with the building paper, provide a backing for *cement plaster*.

[F] WIRELESS PROTECTION SYSTEM. A system or a part of a system that can transmit and receive signals without the aid of wire.

[BS] WOOD SHEAR PANEL. A wood floor, roof or wall component sheathed to act as a *shear wall* or *diaphragm*.

[BS] WOOD STRUCTURAL PANEL. A panel manufactured from *veneers*, wood strands or wafers or a combination of *veneer* and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of *wood structural panels* are:

Composite panels. A wood structural panel that is comprised of wood *veneer* and reconstituted wood-based material and bonded together with waterproof adhesive.

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

Plywood. A wood structural panel comprised of plies of wood *veneer* arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

[BS] WOOD/PLASTIC COMPOSITE. A composite material made primarily from wood or cellulose-based materials and plastic.

[F] WORKSTATION. A defined space or an independent principal piece of equipment using *HPM* within a *fabrication area* where a specific function, laboratory procedure or research activity occurs. *Approved* or *listed hazardous materials storage cabinets*, *flammable liquid* storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain *ventilation* equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

[BS] WYTHE. Each continuous, vertical section of a wall, one *masonry unit* in thickness.

[BG] YARD. An open space, other than a *court*, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

[F] ZONE. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent or an area in which a form of control can be executed.

[F] ZONE, NOTIFICATION. An area within a building or facility covered by notification appliances which are activated simultaneously.

CHAPTER 3
OCCUPANCY CLASSIFICATION AND USE

User note:

About this chapter: *Chapter 3 provides the criteria by which buildings and structures are classified into use groups and occupancies. Through the balance of the code, occupancy classification is fundamental in the setting of features of construction; occupant safety requirements, especially building limitations; means of egress; fire protection systems; and interior finishes.*

SECTION 301
SCOPE

301.1 General. The provisions of this chapter shall control the classification of all buildings and structures as to occupancy and use. Different classifications of occupancy and use represent varying levels of hazard and risk to building occupants and adjacent properties.

SECTION 302
OCCUPANCY CLASSIFICATION AND USE DESIGNATION

[S] 302.1 Occupancy classification. Occupancy classification is the formal designation of the primary purpose of the building, structure or portion thereof. Structures shall be classified into one or more of the occupancy groups specified in this section based on the nature of the hazards and risks to building occupants generally associated with the intended purpose of the building or structure. An area, room or space that is intended to be occupied at different times for different purposes shall comply with all applicable requirements associated with such potential multipurpose. Structures containing multiple occupancy groups shall comply with Section 508. Where a structure is proposed for a purpose that is not specified in this section, such structure shall be classified in the occupancy it most nearly resembles based on the fire safety and relative hazard. Occupied roofs shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard, and shall comply with Section 503.1.4.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section 304): Group B.
3. Educational (see Section 305): Group E.
4. Factory and Industrial (see Section 306): Groups F-1 and F-2.
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.
6. Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4.
7. Mercantile (see Section 309): Group M.
8. Residential (see Section 310): Groups R-1, R-2, and R-3. ((~~and R-4.~~))
9. Storage (see Section 311): Groups S-1 and S-2.
10. Utility and Miscellaneous (see Section 312): Group U.

302.2 Use designation. Occupancy groups contain subordinate uses having similar hazards and risks to building occupants. Uses include, but are not limited to, those functional designations specified within the occupancy group descriptions in Section 302.1. Certain uses require specific limitations and controls in accordance with the provisions of Chapter 4 and elsewhere in this code.

SECTION 303
ASSEMBLY GROUP A

303.1 Assembly Group A. Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation.

303.1.1 Small buildings and tenant spaces. A building or tenant space used for assembly purposes with an *occupant load* of less than 50 persons shall be classified as a Group B occupancy.

303.1.2 Small assembly spaces. The following rooms and spaces shall not be classified as Assembly occupancies:

1. A room or space used for assembly purposes with an *occupant load* of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
2. A room or space used for assembly purposes that is less than 750 square feet (70 m^2) in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

303.1.3 Associated with Group E occupancies. A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.

303.1.4 Accessory to places of religious worship. Accessory religious educational rooms and religious auditoriums with *occupant loads* of less than 100 per room or space are not considered separate occupancies.

303.1.5 Special amusement areas. *Special amusement areas* shall comply with Section 411.

303.2 Assembly Group A-1. Group A-1 occupancy includes assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

Motion picture theaters

Symphony and concert halls

Television and radio studios admitting an audience

Theaters

303.3 Assembly Group A-2. Group A-2 occupancy includes assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls

Casinos (*gaming areas*)

Nightclubs

Restaurants, cafeterias and similar dining facilities (including associated commercial kitchens)

Taverns and bars

[W] 303.4 Assembly Group A-3. Group A-3 occupancy includes assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

Amusement arcades

Art galleries more than 3,000 gross square feet

Bowling alleys

Community halls

Courtrooms

Dance halls (not including food or drink consumption)

Exhibition halls

Funeral parlors

Greenhouses for the conservation and exhibition of plants that provide public access

Gymnasiums (without spectator seating)

Indoor *swimming pools* (without spectator seating)

Indoor tennis courts (without spectator seating)

Lecture halls

Libraries

Museums

Places of religious worship

Pool and billiard parlors

Waiting areas in transportation terminals

303.5 Assembly Group A-4. Group A-4 occupancy includes assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

Arenas

Skating rinks

Swimming pools

Tennis courts

303.6 Assembly Group A-5. Group A-5 occupancy includes assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

Amusement park structures

Bleachers

Grandstands

Stadiums

SECTION 304
BUSINESS GROUP B

[S] 304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

Airport traffic control towers

Ambulatory care facilities

Animal hospitals, kennels and pounds

Banks

Barber and beauty shops

Car wash

Civic administration

Clinic, outpatient

Dry cleaning and laundries: pick-up and delivery stations and self-service

Educational occupancies for students above the 12th grade including *higher education laboratories*

Electronic data processing

Food processing establishments and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities, and not more than 2,500 square feet (232 m^2) in area

Laboratories: testing and research

Motor vehicle showrooms

Post offices

Print shops

Professional services (architects, attorneys, dentists, physicians, engineers, etc.)

Radio and television stations

Telephone exchanges

Training and skill development not in a school or academic program (this shall include, but not be limited to, tutoring centers, martial arts studios, gymnastics and similar uses regardless of the ages served, and where not classified as a Group A occupancy)

304.2 Airport traffic control towers. Airport traffic control towers shall comply with Section 412.2.

304.3 Ambulatory care facilities. *Ambulatory care facilities* shall comply with Section 422.

304.4 Higher education laboratories. *Higher education laboratories* shall comply with Section 428.

SECTION 305
EDUCATIONAL GROUP E

305.1 Educational Group E. Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade.

305.1.1 Accessory to places of religious worship. Religious educational rooms and religious auditoriums, which are accessory to *places of religious worship* in accordance with Section 303.1.4 and have *occupant loads* of less than 100 per room or space, shall be classified as Group A-3 occupancies.

305.2 Group E, day care facilities. This group includes buildings and structures or portions thereof occupied by more than five children older than 2-1/2 years of age who receive educational, supervision or *personal care services* for fewer than 24 hours per day.

305.2.1 Within places of religious worship. Rooms and spaces within *places of religious worship* providing such day care during religious functions shall be classified as part of the primary occupancy.

305.2.2 Five or fewer children. A facility having five or fewer children receiving such day care shall be classified as part of the primary occupancy.

305.2.3 Five or fewer children in a dwelling unit. A facility such as the above within a *dwelling unit* and having five or fewer children receiving such day care shall be classified as a Group R-3 occupancy or shall comply with the *International Residential Code*.

[W] 305.2.4 Family home child care. *Family home child care* licensed by Washington State for the care of twelve or fewer children shall be classified as Group R-3 or shall comply with the *International Residential Code.*

305.3 Storm shelters in Group E occupancies. *Storm shelters* shall be provided for Group E occupancies where required by Section 423.5.

SECTION 306
FACTORY GROUP F

306.1 Factory Industrial Group F. Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

[W][S] 306.2 Moderate-hazard factory industrial, Group F-1. Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

Aircraft (manufacturing, not to include repair)

Appliances

Athletic equipment

Automobiles and other motor vehicles

Bakeries

Beverages: over 16-percent alcohol content

Bicycles

Boats

Brooms or brushes

Business machines

Cameras and photo equipment

Canvas or similar fabric

Carpets and rugs (includes cleaning)

Clothing

Construction and agricultural machinery

Disinfectants

Dry cleaning and dyeing

Electric generation plants

Electronics

Energy storage systems (ESS) in dedicated use buildings

Engines (including rebuilding)

Food processing establishments and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities, and more than 2,500 square feet (232 m^2) in area

Furniture

Hemp products

Jute products

Laundries

Leather products
Machinery
Marijuana processing
Metals
Millwork (sash and door)
Motion pictures and television filming (without spectators)
Musical instruments
Optical goods
Paper mills or products
Photographic film
Plastic products
Printing or publishing
Recreational vehicles
Refuse incineration
Shoes
Soaps and detergents
Textiles
Tobacco
Trailers
Upholstering
Water/sewer treatment facilities
Wood; distillation
Woodworking (cabinet)

306.2.1 Aircraft manufacturing facilities. Aircraft manufacturing facilities shall comply with Section 412.6.

306.3 Low-hazard factory industrial, Group F-2. Factory industrial uses that involve the fabrication or manufacturing of noncombustible materials that during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

Beverages: up to and including 16-percent alcohol content
Brick and masonry
Ceramic products
Foundries
Glass products
Gypsum
Ice
Metal products (fabrication and assembly)

SECTION 307
HIGH-HAZARD GROUP H

[F] 307.1 High-hazard Group H. High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or *health hazard* in quantities in excess of those allowed in *control areas* complying with Section 414, based on the maximum allowable quantity limits for *control areas* set forth in Tables 307.1(1) and 307.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *International Fire Code*. *Hazardous materials* stored, or used on top of roofs or canopies, shall be classified as outdoor storage or use and shall comply with the *International Fire Code*.

Consumer *fireworks*, 1.4G (Class C, Common)

Cryogenic fluids, oxidizing

Flammable solids

Organic peroxides, Class II and III

Oxidizers, Class 2

Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less

Oxidizing gases

Unstable (reactive) materials, Class 2

Water-reactive materials, Class 2

[F] 307.6 High-hazard Group H-4. Buildings and structures containing materials that are *health hazards* shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

Corrosives

Highly toxic materials

Toxic materials

[F] 307.7 High-hazard Group H-5. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those specified in Table 307.1(1) and [F] Table 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.11.

[F] 307.8 Multiple hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

SECTION 308
INSTITUTIONAL GROUP I

308.1 Institutional Group I. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are *incapable of self-preservation* without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.

[W] 308.2 Institutional Group I-1. Institutional Group I-1 occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a *24-hour basis* in a supervised environment and receive *custodial care*. Buildings of Group I-1 shall be classified as one of the occupancy conditions specified in Section 308.2.1 or 308.2.2 and shall comply with Section 420. This group shall include, but not be limited to, the following:

Alcohol and drug centers

Assisted living facilities as licensed by Washington state under chapter 388-78A WAC

Congregate care facilities

Group homes

Halfway houses

Residential board and care facilities

Residential treatment facilities as licensed by Washington state under chapter 246-337 WAC

Social rehabilitation facilities

308.2.1 Condition 1. This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete building evacuation.

308.2.2 Condition 2. This occupancy condition shall include buildings in which there are any persons receiving *custodial care* who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.

308.2.3 Six to 16 persons receiving custodial care. A facility housing not fewer than six and not more than 16 persons receiving *custodial care* shall be classified as Group R-4.

308.2.4 Five or fewer persons receiving custodial care. A facility with five or fewer persons receiving *custodial care* shall be classified as Group R-3 or shall comply with the *International Residential Code* provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code*.

[W] 308.2.5 Adult family homes. *Adult family homes* licensed by Washington State shall be classified as Group R-3 or shall comply with the *International Residential Code*.

[W] 308.2.6 Assisted living facilities. Assisted living facilities as licensed by Washington State under chapter 388-78A WAC shall be classified as Group I-1, Condition 2.

[W] 308.3 Institutional Group I-2. Institutional Group I-2 occupancy shall include buildings and structures used for *medical care* on a *24-hour basis* for more than five persons who are *incapable of self-preservation*. This group shall include, but not be limited to, the following:

Foster care facilities

Detoxification facilities

Hospice care centers

Hospitals

Nursing homes

Psychiatric hospitals

308.3.1 Occupancy conditions. Buildings of Group I-2 shall be classified as one of the occupancy conditions specified in Section 308.3.1.1 or 308.3.1.2 and shall comply with Section 407.

308.3.1.1 Condition 1. This occupancy condition shall include facilities that provide nursing and *medical care* but do not provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to *nursing homes* and *foster care facilities.*

308.3.1.2 Condition 2. This occupancy condition shall include facilities that provide nursing and *medical care* and could provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to *hospitals.*

308.3.2 Five or fewer persons receiving *medical care*. A facility with five or fewer persons receiving *medical care* shall be classified as Group R-3 or shall comply with the *International Residential Code* provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code*.

308.4 Institutional Group I-3. Institutional Group I-3 occupancy shall include buildings and structures that are inhabited by more than five persons who are under restraint or security. A Group I-3 facility is occupied by persons who are generally *incapable of self-preservation* due to security measures not under the occupants' control. This group shall include, but not be limited to, the following:

Correctional centers

Detention centers

Jails

Prerelease centers

Prisons

Reformatories

Buildings of Group I-3 shall be classified as one of the occupancy conditions specified in Sections 308.4.1 through 308.4.5 and shall comply with Section 408.

308.4.1 Condition 1. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via *means of egress* without restraint. A Condition 1 facility is permitted to be constructed as Group R.

308.4.2 Condition 2. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied *smoke compartment* to one or more other *smoke compartments*. Egress to the exterior is impeded by locked exits.

308.4.3 Condition 3. This occupancy condition shall include buildings in which free movement is allowed within individual *smoke compartments*, such as within a residential unit composed of individual *sleeping units* and group activity spaces, where egress is impeded by remote-controlled release of *means of egress* from such a *smoke compartment* to another *smoke compartment*.

308.4.4 Condition 4. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from *sleeping units*, activity spaces and other occupied areas within the *smoke compartment* to other *smoke compartments*.

308.4.5 Condition 5. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from *sleeping units*, activity spaces and other occupied areas within the *smoke compartment* to other *smoke compartments*.

308.5 Institutional Group I-4, day care facilities. Institutional Group I-4 occupancy shall include buildings and structures occupied by more than five persons of any age who receive *custodial care* for fewer than 24 hours per day by persons other than parents or guardians; relatives by blood, marriage or adoption; and in a place other than the home of the person cared for. This group shall include, but not be limited to, the following:

Adult day care

Child day care

308.5.1 Classification as Group E. A child day care facility that provides care for more than five but not more than 100 children 2-1/2 years or less of age, where the rooms in which the children are cared for are located on a *level of exit discharge* serving such rooms and each of these child care rooms has an *exit* door directly to the exterior, shall be classified as Group E.

308.5.2 Within a place of religious worship. Rooms and spaces within *places of religious worship* providing such care during religious functions shall be classified as part of the primary occupancy.

308.5.3 Five or fewer persons receiving care. A facility having five or fewer persons receiving *custodial care* shall be classified as part of the primary occupancy.

308.5.4 Five or fewer persons receiving care in a dwelling unit. A facility such as the above within a *dwelling unit* and having five or fewer persons receiving *custodial care* shall be classified as a Group R-3 occupancy or shall comply with the *International Residential Code*.

[W] 308.5.5 Family home child care. *Family home child care* licensed by Washington state for the care of 12 or fewer children shall be classified as Group R-3 or shall comply with the *International Residential Code*.

SECTION 309
MERCANTILE GROUP M

[W] 309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and where the public has access. Mercantile occupancies shall include, but not be limited to, the following:

Art galleries, 3,000 gross square feet or less

Department stores

Drug stores

Markets

Greenhouses for display and sale of plants that provide public access.

Motor fuel-dispensing facilities

Retail or wholesale stores

Sales rooms

309.2 Quantity of hazardous materials. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid *hazardous materials* stored or displayed in a single *control area* of a Group M occupancy shall not exceed the quantities in Table 414.2.5(1).

309.3 Motor fuel-dispensing facilities. Motor fuel-dispensing facilities shall comply with Section 406.7.

SECTION 310
RESIDENTIAL GROUP R

310.1 Residential Group R. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *International Residential Code*. Group R occupancies not constructed in accordance with the *International Residential Code* as permitted by Sections 310.4.1 and 310.4.2 shall comply with Section 420.

310.2 Residential Group R-1. Residential Group R-1 occupancies containing *sleeping units* where the occupants are primarily *transient* in nature, including:

Boarding houses (*transient*) with more than 10 occupants

Congregate living facilities (*transient*) with more than 10 occupants

Hotels (*transient*)

Motels (*transient*)

[S] 310.3 Residential Group R-2. Residential Group R-2 occupancies containing *sleeping units* or more than two *dwelling units* where the occupants are primarily permanent in nature, including:

Apartment houses

Congregate living facilities (nontransient) with more than 16 occupants

Boarding houses (*nontransient*)

Convents

Dormitories

Fraternities and sororities

Monasteries

Hotels (nontransient)

((~~*Live/work*~~)) Buildings that contain three or more *live/work units*

Motels (nontransient)

Vacation timeshare properties

[S] 310.4 Residential Group R-3. Residential Group R-3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, including:

Buildings that do not contain more than two *dwelling units*

Buildings that do not contain more than two live/work units

Care facilities that provide accommodations for five or fewer persons receiving care

Congregate living facilities (nontransient) with 16 or fewer occupants

Boarding houses (nontransient)

Convents

Dormitories

Fraternities and sororities

Monasteries

Congregate living facilities (*transient*) with 10 or fewer occupants

Boarding houses (*transient*)

Lodging houses (*transient*) with five or fewer *guest rooms* and 10 or fewer occupants

310.4.1 Care facilities within a dwelling. Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the *International Residential Code* provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code*.

310.4.2 Lodging houses. Owner-occupied *lodging houses* with five or fewer *guest rooms* and 10 or fewer total occupants shall be permitted to be constructed in accordance with the *International Residential Code,* provided that an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code.*

[W] 310.4.3 Adult family homes, family home child care. *Adult family homes* and *family home child care* facilities that are within a single-family home are permitted to comply with the *International Residential Code*.

[W] 310.4.4 Foster family care homes. Foster family care homes licensed by Washington State are permitted to comply with the International Residential Code, as an accessory use to a *dwelling*, for six or fewer children including those of the resident family.

[W] 310.5 Residential Group R-4. Residential Group R-4 occupancy shall include buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside on a *24-hour basis* in a supervised residential environment and receive *custodial care*. Buildings of Group R-4 shall be classified as one of the occupancy conditions specified in Section 310.5.1 or 310.5.2. This group shall include, but not be limited to, the following:

Alcohol and drug centers

Assisted living facilities

Congregate care facilities

Group homes

Halfway houses

Residential board and care facilities

Social rehabilitation facilities

Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in this code.

310.5.1 Condition 1. This occupancy condition shall include buildings in which all persons receiving *custodial care*, without any assistance, are capable of responding to an emergency situation to complete building evacuation.

310.5.2 Condition 2. This occupancy condition shall include buildings in which there are any persons receiving *custodial care* who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.

SECTION 311
STORAGE GROUP S

311.1 Storage Group S. Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

311.1.1 Accessory storage spaces. A room or space used for storage purposes that is accessory to another occupancy shall be classified as part of that occupancy.

311.1.2 Combustible storage. High-piled stock or rack storage, or *attic*, under-floor and concealed spaces used for storage of combustible materials, shall be in accordance with Section 413.

311.2 Moderate-hazard storage, Group S-1. Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

Aerosol products, Levels 2 and 3

Aircraft hangar (storage and repair)

Bags: cloth, burlap and paper

Bamboos and rattan

Baskets

Belting: canvas and leather

Beverages over 16-percent alcohol content

Books and paper in rolls or packs

Boots and shoes

Buttons, including cloth covered, pearl or bone

Cardboard and cardboard boxes

Clothing, woolen wearing apparel

Cordage

Dry boat storage (indoor)

Furniture

Furs

Glues, mucilage, pastes and size

Grains

Horns and combs, other than celluloid

Leather

Linoleum

Lumber

Motor vehicle *repair garages* complying with the maximum allowable quantities of *hazardous materials* specified in Table 307.1(1) (see Section 406.8)

Photo engravings

Resilient flooring

Self-service storage facility (mini-storage)

Silks

Soaps

Sugar

Tires, bulk storage of

Tobacco, cigars, cigarettes and snuff

Upholstery and mattresses

Wax candles

311.2.1 Aircraft hangers. Aircraft hangars used for storage or repair shall comply with Section 412.3.

311.2.2 Motor vehicle repair garages Motor vehicle *repair garages* shall comply with Section 406.8.

[S] 311.3 Low-hazard storage, Group S-2. Storage Group S-2 occupancies include, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic *trim*, such as knobs, handles or film wrapping. Group S-2 storage uses shall include, but not be limited to, storage of the following:

Asbestos

Beverages up to and including 16-percent alcohol

Cement in bags

Chalk and crayons

Covered boat moorage not classified as Group U

Dairy products in nonwaxed coated paper containers

Dry cell batteries

Electrical coils

Electrical motors

Empty cans

Food products

Foods in noncombustible containers

Fresh fruits and vegetables in nonplastic trays or containers

Frozen foods

Glass

Glass bottles, empty or filled with noncombustible liquids

Gypsum board

Inert pigments

Ivory

Meats

Metal cabinets

Metal desks with plastic tops and *trim*

Metal parts

Metals

Mirrors

Oil-filled and other types of distribution transformers

Public parking garages, open or enclosed

Porcelain and pottery

Stoves

Talc and soapstones

Washers and dryers

311.3.1 Public parking garages. Public parking garages shall comply with Section 406.4 and the additional requirements of Section 406.5 for *open parking garages* or Section 406.6 for enclosed parking garages.

SECTION 312
UTILITY AND MISCELLANEOUS GROUP U

[S] 312.1 General. Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

Agricultural buildings

Aircraft hangars, accessory to a one- or two-family residence (see Section 412.4)

Barns

Carports

Communication equipment structures with a *gross floor area* of less than 1,500 square feet (139 m^2)

Covered boat moorage accessory to Group R-3 *dwelling unit*

Fences more than 7 feet (2134 mm) in height

Grain silos, accessory to a residential occupancy

Livestock shelters

Private garages that comply with Section 406.3

Retaining walls

Sheds

Stables

Tanks

Towers

312.1.1 Greenhouses. *Greenhouses* not classified as another occupancy shall be classified as Use Group U.

312.2 Private garages and carports. *Private garages* and carports shall comply with Section 406.3.

312.3 Residential aircraft hangars. Aircraft hangars accessory to a one- or two-family residence shall comply with Section 412.4.

CHAPTER 4

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

User note:

About this chapter: *Chapter 4 provides detailed criteria for special uses and occupancies. The unique characteristics of a live/work unit as opposed to a 30-story high-rise building call for specific standards for each. Twenty-seven sections address covered and open mall buildings, atriums, hospitals, stages, buildings where hazardous materials are used and stored, jails and prisons, ambulatory care facilities and storm shelters, among other special occupancy issues.*

SECTION 401
SCOPE

401.1 Detailed occupancy and use requirements. In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the occupancies and use described herein.

SECTION 402
COVERED MALL AND OPEN MALL BUILDINGS

402.1 Applicability. The provisions of this section shall apply to buildings or structures defined herein as *covered or open mall buildings* not exceeding three floor levels at any point nor more than three *stories above grade plane*. Except as specifically required by this section, *covered and open mall buildings* shall meet applicable provisions of this code.

Exceptions:

1. Foyers and lobbies of Group B, R-1 and R-2 occupancies are not required to comply with this section.
2. Buildings need not comply with the provisions of this section where they totally comply with other applicable provisions of this code.

402.1.1 Open mall building perimeter line. For the purpose of this code, a perimeter line shall be established. The perimeter line shall encircle all buildings and structures that comprise the *open mall building* and shall encompass any open-air interior walkways, open-air courtyards or similar open-air spaces. The perimeter line shall define the extent of the *open mall building*. *Anchor buildings* and parking structures shall be outside of the perimeter line and are not considered as part of the *open mall building*.

402.2 Open space. A *covered mall building* and attached *anchor buildings* and parking garages shall be surrounded on all sides by a permanent open space or not less than 60 feet (18 288 mm). An *open mall building* and *anchor buildings* and parking garages adjoining the perimeter line shall be surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm).

Exception: The permanent open space of 60 feet (18 288 mm) shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided that the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the *covered or open mall building* and *anchor buildings*.
2. The *exterior wall* facing the reduced open space shall have a *fire-resistance rating* of not less than 3 hours.
3. Openings in the *exterior wall* facing the reduced open space shall have opening protectives with a *fire protection rating* of not less than 3 hours.
4. Group E, H, I or R occupancies are not located within the *covered or open mall building* or *anchor buildings*.

[S] ((~~402.3 Lease plan.~~ ~~Each *owner* of a *covered mall building* or of an *open mall building* shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its *exits* after the certificate of occupancy has been issued. Modifications or changes in occupancy or use from that shown on the lease plan shall not be made without prior approval of the *building official*.~~))

402.4 Construction. The construction of *covered and open mall buildings*, *anchor buildings* and parking garages associated with a mall building shall comply with Sections 402.4.1 through 402.4.3.

[F] 402.7.2 Smoke control. *Atriums* connecting three or more *stories* in a *covered mall building* shall be provided with a smoke control system in accordance with Section 909.

[S][F] 402.7.3 Emergency power system. *Covered mall buildings* greater than 50,000 square feet (4645 m^2) in area and *open mall buildings* greater than 50,000 square feet (4645 m^2) within the established perimeter line shall be provided with emergency power *systems* that is capable of operating the *emergency voice/alarm communication system* in accordance with Section 2702.

[F] 402.7.4 Emergency voice/alarm communication system. Where the total floor area is greater than 50,000 square feet (4645 m^2) within either a *covered mall building* or within the perimeter line of an *open mall building*, an *emergency voice/alarm communication system* shall be provided.

The fire department shall have access to any *emergency voice/alarm communication systems* serving a *mall*, required or otherwise. The systems shall be provided in accordance with Section 907.5.2.2.

[F] 402.7.5 Fire department access to equipment. Rooms or areas containing controls for air-conditioning systems or *fire protection systems* shall be identified for use by the fire department.

402.8 Means of egress. *Covered mall buildings*, *open mall buildings* and each tenant space within a *mall building* shall be provided with *means of egress* as required by this section and this code. Where there is a conflict between the requirements of this code and the requirements of Sections 402.8.1 through 402.8.8, the requirements of Sections 402.8.1 through 402.8.8 shall apply.

402.8.1 Mall width. For the purpose of providing required egress, *malls* are permitted to be considered as corridors but need not comply with the requirements of Section 1005.1 of this code where the width of the *mall* is as specified in this section.

402.8.1.1 Minimum width. The aggregate clear egress width of the *mall* in either a *covered or open mall building* shall be not less than 20 feet (6096 mm). The *mall* width shall be sufficient to accommodate the *occupant load* served. Any portion of the minimum required aggregate egress width shall be not less than 10 feet (3048 mm) measured to a height of 8 feet (2438 mm) between any projection of a tenant space bordering the *mall* and the nearest kiosk, vending machine, bench, display opening, *food court* or other obstruction to *means of egress* travel.

402.8.2 Determination of occupant load. The *occupant load* permitted in any individual tenant space in a *covered or open mall building* shall be determined as required by this code. *Means of egress* requirements for individual tenant spaces shall be based on the *occupant load* thus determined.

402.8.2.1 Occupant formula. In determining required *means of egress* of the *mall*, the number of occupants for whom *means of egress* are to be provided shall be based on *gross leasable area* of the *covered or open mall building* (excluding *anchor buildings*) and the *occupant load factor* as determined by Equation 4-1.

$$OLF = (0.00007)(GLA) + 25 \qquad \textbf{(Equation 4-1)}$$

where:

OLF = The *occupant load* factor (square feet per person).

GLA = The *gross leasable area* (square feet).

Exception: Tenant spaces attached to a *covered or open mall building* but with a *means of egress* system that is totally independent of the open mall of an *open mall building* or of a *covered mall building* shall not be considered as *gross leasable area* for determining the required *means of egress* for the *mall building*.

402.8.2.2 OLF range. The *occupant load* factor (*OLF*) is not required to be less than 30 and shall not exceed 50.

402.8.2.3 Anchor buildings. The *occupant load* of *anchor buildings* opening into the *mall* shall not be included in computing the total number of occupants for the *mall*.

402.8.2.4 Food courts. The *occupant load* of a *food court* shall be determined in accordance with Section 1004. For the purposes of determining the *means of egress* requirements for the *mall*, the *food court occupant load* shall be added to the *occupant load* of the covered or *open mall building* as calculated in Section 402.8.2.1.

402.8.3 Number of means of egress. Wherever the distance of travel to the *mall* from any location within a tenant space used by persons other than employees is greater than 75 feet (22 860 mm) or the tenant space has an *occupant load* of 50 or more, not fewer than two *means of egress* shall be provided.

402.8.4 Arrangements of means of egress. Assembly occupancies with an *occupant load* of 500 or more located within a *covered mall building* shall be so located such that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required *means of egress* opening directly to the exterior of the *covered mall building*. Assembly occupancies located within the perimeter line of an *open mall building* shall be permitted to have their main *exit* open to the *open mall*.

402.8.4.1 Anchor building means of egress. Required *means of egress* for *anchor buildings* shall be provided independently from the *mall means of egress* system. The *occupant load* of a*nchor buildings* opening into the *mall* shall not be included in determining *means of egress* requirements for the *mall*. The path of egress travel of *malls* shall not exit through *anchor buildings*. Malls terminating at an *anchor building* where other *means of egress* has not been provided shall be considered as a dead-end *mall*.

402.8.5 Distance to exits. Within each individual tenant space in a *covered* or *open mall building*, the distance of travel from any point to an *exit* or entrance to the *mall* shall be not greater than 200 feet (60 960 mm).

The distance of travel from any point within a *mall* of a *covered mall building* to an *exit* shall be not greater than 200 feet (60 960 mm). The maximum distance of travel from any point within an *open mall* to the perimeter line of the *open mall building* shall be not greater than 200 feet (60 960 mm).

402.8.6 Access to exits. Where more than one *exit* is required, they shall be so arranged that it is possible to travel in either direction from any point in a *mall* of a *covered mall building* to separate *exits* or from any point in an *open mall* of an *open mall building* to two separate locations on the perimeter line, provided that neither location is an *exterior wall* of an *anchor building* or parking garage. The width of an *exit passageway* or *corridor* from a *mall* shall be not less than 66 inches (1676 mm).

Exception: Access to *exits* is permitted by way of a dead-end *mall* that does not exceed a length equal to twice the width of the *mall* measured at the narrowest location within the dead-end portion of the *mall*.

402.8.6.1 Exit passageways. Where *exit passageways* provide a secondary *means of egress* from a tenant space, the *exit passageways* shall be constructed in accordance with Section 1024.

402.8.7 Service areas fronting on exit passageways. Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into *exit passageways*, provided that the *exit passageway* is separated from such rooms with not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire protection rating* of openings in the *fire barriers* shall be not less than 1 hour.

402.8.8 Security grilles and doors. Horizontal sliding or vertical security grilles or doors that are a part of a required *means of egress* shall conform to the following:

1. Doors and grilles shall remain in the full open position during the period of occupancy by the general public.
2. Doors or grilles shall not be brought to the closed position when there are 10 or more persons occupying spaces served by a single *exit* or 50 or more persons occupying spaces served by more than one *exit*.
3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more *exits* are required, not more than one-half of the *exits* shall be permitted to include either a horizontal sliding or vertical rolling grille or door.

SECTION 403
HIGH-RISE BUILDINGS

Note: High rise projects over 240 feet in structural height or using an alternative lateral force resisting system are subject to peer review, in accordance with Section 1613. Peer reviews require lengthy lead time prior to permit application and issuance. Applicants should contact the *building official* prior to the start of structural design.

[S] 403.1 Applicability. *High-rise buildings* shall comply with Sections 403.2 through ((~~403.6~~)) 403.8.

Exceptions: The provisions of Sections 403.2 through 403.6 shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with Section 412.2.
2. *Open parking garages* in accordance with Section 406.5.
3. The portion of a building containing a Group A-5 occupancy in accordance with Section 303.6.
4. Special industrial occupancies in accordance with Section 503.1.1.

((~~5. Buildings containing any one of the following:~~

~~5.1. A Group H-1 occupancy.~~

~~5.2. A Group H-2 occupancy in accordance with Section 415.8, 415.9.2, 415.9.3 or 426.1.~~

~~5.3. A Group H-3 occupancy in accordance with Section 415.8.~~))

Interpretation I403.1a: Item 2 only includes buildings in which parking is the principal use.

Interpretation I403.1b: For the purpose of this section, occupied roofs are considered floors used for human occupancy if the occupant load of the roof is ten or more on a building not equipped with an *automatic sprinkler system* or where the occupant load is 50 or more on the roof of a building that is equipped with an *automatic sprinkler system*.

403.1.1 Presubmittal conferences. The applicant shall arrange two presubmittal conferences with the design team, the *building official* and the *fire code official* in accordance with Sections 403.1.1.1 and 403.1.1.2.

403.1.1.1 High rise presubmittal conference. The applicant shall arrange a high rise presubmittal conference at least 60 days prior to submittal of a building permit application that contains the construction documents for any structural component of the building. The purpose of this presubmittal conference is to obtain conceptual approval of the design team approach to compliance with key provisions of this code related to high rise construction, excluding smoke control. The documentation of the high rise presubmittal meetings shall be reflected on the plans for the building and become a permanent part of the records of the Department of Construction and Inspections.

403.1.1.2 Smoke control presubmittal conference. The applicant shall arrange a smoke control presubmittal conference in accordance with Section 909.1.1.

[S] 403.2 Construction. The construction of *high-rise buildings* shall comply with the provisions of Sections 403.2.1 through 403.2.3.

403.2.1 Reduction in fire-resistance rating. The *fire-resistance rating* reductions specified in Sections 403.2.1.1 and 403.2.1.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

403.2.1.1 Type of construction. The following reductions in the minimum *fire-resistance rating* of the *building elements* in TABLE 601 shall be permitted as follows:

1. For buildings not greater than 420 feet (128 m) in *building height*, the *fire-resistance rating* of the *building elements* in Type IA construction shall be permitted to be reduced to the minimum *fire-resistance ratings* for the *building elements* in Type IB.

   Exception: The required *fire-resistance rating* of ((~~columns supporting floors~~)) primary structural frame and bearing walls shall not be reduced.

2. In other than Group F-1, H-2, H-3, H-5, M and S-1 occupancies, the *fire-resistance rating* of the *building elements* in Type IB construction shall be permitted to be reduced to the *fire-resistance ratings* in Type IIA.
3. The *building height* and *building area* limitations of a building containing *building elements* with reduced *fire-resistance ratings* shall be permitted to be the same as the building without such reductions.

403.2.1.2 Shaft enclosures. For buildings not greater than 420 feet (128 m) in *building height*, the required *fire-resistance rating* of the *fire barriers* enclosing vertical *shafts*, other than *interior exit stairway* and elevator hoistway enclosures, is permitted to be reduced to 1 hour where *automatic* sprinklers are installed within the *shafts* at the top and at alternate floor levels.

[S][BS] 403.2.2 Structural integrity of interior exit stairways and elevator hoistway enclosures. Enclosures of fire service access elevators per Section 403.6.1 shall comply with Sections 403.2.2.1 through 403.2.2.4. For *high-rise buildings of Risk Category* III or IV in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 m) in *building height*, enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Sections 403.2.2.1 through 403.2.2.4.

[BS] 403.2.2.1 Wall assembly materials—soft body impact. The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M when tested from the exterior side of the enclosure.

[BS] 403.2.2.2 Wall assembly materials—hard body impact. The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures that are not exposed to the interior of the enclosure shall be in accordance with one of the following:

1. The wall assembly shall incorporate not fewer than two layers of impact-resistant panels, each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not fewer than one layer of impact-resistant panels that meet or exceed Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.2.3 Concrete and masonry walls. Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.2.1 and 403.2.2.2.

[BS] 403.2.2.4 Other wall assemblies. Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.2.1 for Soft Body Impact Classification Level 2 and 403.2.2.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

403.2.3 Sprayed fire-resistant materials (SFRM). The bond strength of the SFRM installed throughout the building shall be in accordance with Table 403.2.3.

TABLE 403.2.3
MINIMUM BOND STRENGTH

HEIGHT OF BUILDING[a]	SFRM MINIMUM BOND STRENGTH
Up to 420 feet	430 psf
Greater than 420 feet	1,000 psf

For SI: 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kW/m^2.
a. Above the lowest level of fire department vehicle access.

[S][F] 403.3 Automatic sprinkler system. Buildings and structures shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 403.3.3. See Section 903.3.1.1.3 for additional requirements for sprinkler systems in high-rise buildings.

Exception: An *automatic sprinkler system* shall not be required in spaces or areas of telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an *automatic* fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or not less than 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

[S][F] ((~~403.3.1 Number of sprinkler risers and system design.~~ ~~Each sprinkler system zone in buildings that are more than 420 feet (128 m) in *building height* shall be supplied by not fewer than two risers. Each riser shall supply sprinklers on alternate floors. If more than two risers are provided for a zone, sprinklers on adjacent floors shall not be supplied from the same riser.~~))

[S][F] 403.3.1 Automatic sprinkler system design. High-rise building sprinkler systems shall be combination standpipe/sprinkler systems incorporating the following features:

1. Each floor sprinkler system shall be connected between standpipe risers.
2. Shut-off valves, water-flow devices and check valves (or pressure reducing valves) shall be provided on each floor at the sprinkler system connection to each standpipe.
3. Two four-way fire department connections serving the combination system shall be provided on separate streets well separated from each other.
4. When a mid-level fire pump is required to meet pressure requirements, two pumps with the same rating shall be installed.
5. Dry-pipe sprinkler systems serving parking garages may use a separate two-way fire department connection. The dry-pipe sprinkler system shall be supplied by the on-site water tank.
6. The standpipe risers in each required stair shall be a minimum pipe size of 6 inches (152 mm).
7. Two 2-1/2-inch (64 mm) hose connections shall be provided on every floor level landing in every required stairway. If pressure reducing valves (PRV) are required, each hose connection shall be provided with its own PRV.
8. The system shall be designed to provide a minimum flow of 300 gpm (19 L/s) at a minimum pressure of 150 psi 1034 kPa [maximum 205 psi (1379 kPa)] at each standpipe connection in addition to the flow and pressure requirements contained in NFPA 14.

[F] 403.3.1.1 Riser location. Sprinkler risers shall be placed in *interior exit stairways* and *ramps* that are remotely located in accordance with Section 1007.1.

[F] 403.3.2 Water supply to required fire pumps. In all buildings that are more than 420 feet (128 m) in *building height* and buildings of Type IVA and IVB construction that are more than 120 feet (36 576 mm) in *building height*, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

Exception: Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

[S][F] 403.3.3 Secondary water supply. An *automatic* secondary on-site water supply having a capacity providing the lesser of a net volume of 33,000 gallons or a volume that is not less than the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for *high-rise buildings* assigned to *Seismic Design Category* C, D, E or F as determined by Section 1613. An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump supplying the *automatic sprinkler system*. The secondary water supply shall have a duration of not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13.

[F] 403.3.4 Fire pump room. Fire pumps shall be located in rooms protected in accordance with Section 913.2.1.

[F] 403.4 Emergency systems. The detection, alarm and emergency systems of *high-rise buildings* shall comply with Sections 403.4.1 through 403.4.8.

[F] 403.4.1 Smoke detection. Smoke detection shall be provided in accordance with Section 907.2.13.1.

[F] 403.4.2 Fire alarm system. A *fire alarm* system shall be provided in accordance with Section 907.2.13.

[F] 403.4.3 Standpipe system. A *high-rise building* shall be equipped with a *standpipe system* as required by Section 905.3.

[F] 403.4.4 Emergency voice/alarm communication system. An *emergency voice/alarm communication system* shall be provided in accordance with Section 907.5.2.2.

[F] 403.4.5 Emergency communication coverage. In-building, two-way emergency responder communication coverage shall be provided in accordance with Section 510 of the *International Fire Code*.

[F] 403.4.6 Fire command. A *fire command center* complying with Section 911 shall be provided in a location *approved* by the fire code official.

[S][F] 403.4.7 ((~~Smoke removal~~)) No requirements. ((~~To facilitate smoke removal in post-fire salvage and overhaul operations, buildings and structures shall be equipped with natural or mechanical *ventilation* for removal of products of combustion in accordance with one of the following:~~

1. ~~Easily identifiable, manually operable windows or panels shall be distributed around the perimeter of each floor at not more than 50 foot (15 240 mm) intervals. The area of operable windows or panels shall be not less than 40 square feet (3.7 m^2) per 50 linear feet (15 240 mm) of perimeter.~~

   ~~**Exceptions:**~~

   1. ~~In Group R-1 occupancies, each *sleeping unit* or suite having an *exterior wall* shall be permitted to be provided with 2 square feet (0.19 m^2) of venting area in lieu of the area specified in Item 1.~~
   2. ~~Windows shall be permitted to be fixed provided that glazing can be cleared by fire fighters.~~

2. ~~Mechanical air-handling equipment providing one exhaust air change every 15 minutes for the area involved. Return and exhaust air shall be moved directly to the outside without recirculation to other portions of the building.~~
3. ~~Any other *approved* design that will produce equivalent results.~~))

[S][F] 403.4.8 ((~~Standby and emergency~~)) Emergency power. ((~~A *standby power system* complying with Section 2702 and Section 3003 shall be provided for the standby power loads specified in Section 403.4.8.3.~~)) An *emergency power system* complying with Section 2702 shall be provided for the emergency power loads specified in Section 403.4.8.4.

[F] 403.4.8.1 Equipment room. If the ((~~*standby or*~~)) *emergency power system* includes a generator set inside a building, the system shall be located in a separate room enclosed with 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. System supervision with manual start and transfer features shall be provided at the *fire command center*.

Exceptions:

1. In Group I-2, Condition 2, manual start and transfer features for the critical branch of the emergency power are not required to be provided at the *fire command center*.
2. Where located within a sprinklered parking garage of Type I or II construction, emergency power and *legally required standby power systems* with fixed fuel quantities meeting the limits of Section 605.4.2.2 of the *International Fire Code*, and their transfer switches, are not required to be in a separate room. Other occupancies located in the *story* where the system is located shall be separated from the system by fire barriers with a minimum 1-hour fire-resistance rating.
3. Combustion and radiator intake air are permitted to be transferred from the adjacent garage. Radiator discharge air is permitted to be transferred to the adjacent garage. Radiator ventilation intake and discharge air locations shall be separated to maintain the radiator ventilation intake air temperature below the maximum temperature allowed to meet the emergency and *legally required standby power system* loads.

[S][F] 403.4.8.2 Fuel line piping protection. Fuel lines supplying a generator set inside a building shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than ((~~2 hours. Where the building is protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, the required rating shall be reduced to~~)) 1 hour.
2. An assembly that has a *fire-resistance rating* of not less than 2 hours. Where the building is protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, ((~~or 903.3.1.2,~~)) the required fire-resistance rating shall be reduced to 1 hour.
3. Other approved methods.

[S] ((~~[F] 403.4.8.3 Standby power loads.~~ ~~The following are classified as standby power loads:~~

~~1. *Ventilation* and *automatic* fire detection equipment for *smokeproof* enclosures.~~

~~2. Elevators.~~

~~3. Where elevators are provided in a *high-rise building* for *accessible* means of egress, fire service access or occupant self evacuation, the *standby power system* shall also comply with Sections 1009.4, 3007 or 3008, as applicable.~~))

[S][F] 403.4.8.4 Emergency power loads. The following are classified as emergency power loads:

1. Exit signs and *means of egress* illumination required by Chapter 10.
2. Elevator car lighting.

((~~3. *Emergency voice/alarm communications systems.*~~))

4. *Automatic* fire detection systems.
5. *Fire alarm* systems.
6. Electrically powered fire pumps.
7. Power and lighting for mechanical equipment rooms and the *fire command center* required by Section 403.4.6.
8. Lighting for elevator cars, machine rooms, machine spaces and control rooms.
9. Ventilation and cooling equipment for elevator machine rooms, machine spaces and control rooms.
10. Ventilation and automatic fire detection equipment for pressurized stairways and elevator hoistways.
11. Smoke control system.
12. A selected elevator in each elevator group, in accordance with Section 3016.9. All elevators shall be transferable to an *emergency power system*.

Note: No more than four cars are permitted within a hoistway. See Section 3016.10.

13. For fire service access and occupant evacuation elevators:
    - 13.1. Operation of all fire service access elevator cars.
    - 13.2. Operation of all occupant evacuation elevators until they are recalled.
    - 13.3. Elevator controller cooling equipment.
    - 13.4. For fire service access elevators only, elevator hoistway lighting.
    - 13.5. Sump pumps in elevator pits, where provided.
14. Emergency responder radio coverage.

[S] 403.5 Means of egress and evacuation. The *means of egress* in *high-rise buildings* shall comply with Sections 403.5.1 through ((~~403.5.5~~)) 403.5.7.

403.5.1 Remoteness of interior exit stairways. Required *interior exit stairways* shall be separated by a distance not less than 30 feet (9144 mm) or not less than one-fourth of the length of the maximum overall diagonal dimension of the building or area to be served, whichever is less. The distance shall be measured in a straight line between the nearest points of the enclosure surrounding the *interior exit stairways*. In buildings with three or more *interior exit stairways*, not fewer than two of the *interior exit stairways* shall comply with this section. Interlocking or *scissor stairways* shall be counted as one *interior exit stairway*.

Exception: In buildings containing primarily Group R occupancies, required interior exit stairways are permitted to be separated by a distance not less than 15 feet (4572 mm).

403.5.2 Additional interior exit stairway. For buildings other than Group R-2 and their ancillary spaces that are more than 420 feet (128 m) in *building height*, one additional *interior exit stairway* meeting the requirements of Sections 1011 and 1023 shall be provided in addition to the minimum number of *exits* required by Section 1006.3. The stairway need only serve floors above the lowest level of exit discharge. The total capacity of any combination of remaining *interior exit stairways* with one *interior exit stairway* removed shall be not less than the total capacity required by Section 1005.1. *Scissor stairways* shall not be considered the additional *interior exit stairway* required by this section.

Interpretation I403.5.2 An additional interior exit stairway is not required when the building above the 420-foot level contains only Group R-2 occupancy. If the building above the 420-foot level contains a Group R-2 and another occupancy, or if the building does not contain a Group R-2 above the 420-foot level, then an additional interior exit stairway is required.

Exceptions:

1. ((~~An~~)) Subject to the approval of the *building official*, an additional *interior exit stairway* shall not be required to be installed in buildings having elevators used for occupant self-evacuation in accordance with Section ((~~3008~~)) 403.6.2.
2. An additional *interior exit stairway* shall not be required for other portions of the building where the highest occupiable floor level in those areas is less than 420 feet (128 m) in *building height*.

403.5.3 Stairway door operation. *Stairway* doors other than the exit discharge doors shall be permitted to be locked from the *stairway* side. *Stairway* doors that are locked from the *stairway* side shall be capable of being unlocked simultaneously without unlatching upon a signal from the *fire command center* and shall be capable of being unlocked simultaneously and automatically upon a signal from a fire alarm originating anywhere in the building. When stairway doors are installed that are not locked from the stairway side, wiring shall be installed to facilitate future installations of locking hardware.

403.5.3.1 Stairway communication system. A telephone or other two-way communications system connected to an *approved constantly attended station* shall be provided at not less than every fifth floor in each *stairway*. ((~~where the doors to the *stairway* are locked.~~))

403.5.4 ((~~Smokeproof enclosures~~)) Smoke control in exit stairways. Every required *interior exit stairway* serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall ((~~be a *smokeproof enclosure* in accordance~~)) comply with Sections 909.20 and 1023.12.

Exception: Unless required by other sections of this code, portions of such stairways which serve floors below the level of exit discharge are not required to comply with Sections 909.20 and 1023.11 if the portion of the stairway below the level of exit discharge is separated from the pressurized stairway with not less than 1 hour fire barriers or horizontal assemblies or both.

403.5.5 Luminous egress path markings. Luminous egress path markings shall be provided in accordance with Section 1025.

403.5.6 Access to roofs. Access to all roof levels with a slope less than 4:12 shall be provided by stairways.

Exception: Access to unoccupied roofs is permitted to be provided by ship's ladders or alternating tread devices.

403.5.7 Termination of required stairways. All required interior exit stairways shall terminate at the roof level with an exterior door complying with Sections 1010.1.1 and 1010.1.2, unless an alternate method in accordance with Section 104.5 is *approved* by the *building official*.

[S] 403.6 Elevators. Elevator installation and operation in *high-rise buildings* shall comply with Chapter 30 and ((~~Sections 403.6.1 and 403.6.2~~)) this section.

[S] 403.6.1 Fire service access elevator. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, every floor of the building shall be served by not fewer than two fire service access elevators ((~~, or all elevators, whichever is less, shall be provided~~)) in accordance with ((~~Section 3007~~)) this section. Each fire service access elevator shall have a capacity of not less than 3,500 pounds (1588 kg) and shall comply with Section ((~~3002.4~~)) 3016.15.

Exceptions:

1. Buildings with one elevator shall be provided with one fire service access elevator.
2. Floors below the lowest level of fire department vehicle access are not required to be served by fire service access elevators.
3. Elevators serving only floors less than 75 feet above the lowest street-level building entrance are not required to be fire service access elevators.
4. The elevator shall not be required to serve the top floor of a building where that floor is utilized only for equipment for building systems.

403.6.1.1 Machine rooms. Each fire service access elevator shall be served by a different machine or control room. Each room shall be accessed independently.

403.6.1.2 Water protection. Lobbies serving the fire service access elevator hoistways shall be protected by an *approved* method to prevent water from infiltrating into the hoistway enclosure from the activation of the *automatic sprinkler system* outside the lobbies.

403.6.1.3 Hoistway enclosures. The fire service access elevator hoistway shall be located in a shaft enclosure complying with Section 713.

403.6.1.4 Hoistway lighting. When fire-fighters' emergency operation is active, the entire height of the hoistway shall be illuminated at not less than 1 footcandle (11 lux) as measured from the top of the car of each fire service access elevator.

403.6.1.5 Fire service access elevator lobby. The fire service access elevator shall open into a fire service access elevator lobby in accordance with Sections 403.6.1.5 through 403.6.1.5.5. Egress is permitted through the elevator lobby in accordance with Item 1 of Section 1016.2.

Exception: Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to open into an elevator lobby in accordance with Section 713.14.1.

403.6.1.5.1 Access to interior exit stairway or ramp. The fire service access elevator lobby shall have *direct access* from the enclosed elevator lobby to an enclosure for an interior exit stairway or ramp.

Exception: Access to an *interior exit stairway* or *ramp* shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance with Section 716.2.2.1.

403.6.1.5.2 Lobby enclosure. The fire service access elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 716.2.2.1.

Exceptions:

1. Enclosed fire service access elevator lobbies are not required at the *levels of exit discharge*.
2. Enclosed fire service access elevator lobbies are not required for elevators with pressurized hoistways.

403.6.1.5.3 Lobby doorways. Other than doors to the hoistway or elevator control room, each doorway to a fire service access elevator lobby shall be provided with a 3/4-hour *fire door assembly* complying with Section 716.2. The *fire door assembly* shall also comply with the smoke and draft control door assembly requirements of Section 716.2.2.1.1 with the UL 1784 test conducted without the artificial bottom seal.

403.6.1.5.4 Lobby size. Regardless of the number of fire service access elevators served by the same elevator lobby, the enclosed fire service access elevator lobby shall be not less than 150 square feet (14 m^2) in area with a minimum dimension of 8 feet (2440 mm).

403.6.1.5.5 Fire service access elevator symbol. A pictorial symbol of a standardized design designating which elevators are fire service access elevators shall be installed on each side of the hoistway door frame on the portion of the frame at right angles to the fire service access elevator lobby. The fire service access elevator symbol shall be designed as shown in Figure 403.6.1.5.5 and shall comply with the following:

1. The fire service access elevator symbol shall be not less than 3 inches (76 mm) in height.
2. The helmet shall contrast with the background, with either a light helmet on a dark background or a dark helmet on a light background.
3. The vertical center line of the fire service access elevator symbol shall be centered on the hoistway door frame. Each symbol shall be not less than 78 inches (1981 mm), and not more than 84 (2134 mm) inches above the finished floor at the threshold.

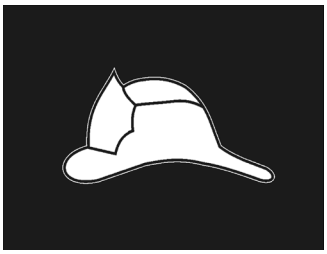

FIGURE 403.6.1.5.5
FIRE SERVICE ACCESS ELEVATOR SYMBOL

403.6.1.6 Elevator system monitoring. The fire service access elevator shall be continuously monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.

403.6.1.7 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or emergency power, control signals, communication with the car, lighting, heating, air conditioning, *ventilation* and fire-detecting systems to fire service access elevators shall be protected by construction having a *fire-resistance rating* of not less than 2 hours, shall be a circuit integrity cable having a *fire-resistance rating* of not less than 2 hours or shall be protected by a listed electrical protective system having a *fire-resistance rating* of not less than 2 hours.

Exception: Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

403.6.1.8 Standpipe hose connection. A Class I standpipe hose connection in accordance with Section 905 shall be provided in the interior exit stairway and ramp having direct access from the fire service access elevator lobby.

403.6.1.8.1 Access. The exit enclosure containing the standpipe shall have access to the floor without passing through the fire service access elevator lobby.

403.6.2 Occupant evacuation elevators. ((~~Where~~)) Elevators installed ((~~in accordance with Section 3008, passenger elevators for general public use~~)) for compliance with Section 403.5.2, shall ((~~be permitted to be used for occupant self-evacuation~~)) comply with Sections 403.6.2.1 through 403.6.2.10.1. Where other elevators are used for occupant self-evacuation, they shall also comply with these sections.

403.6.2.1 Number of occupant evacuation elevators. The number of elevators available for occupant evacuation shall be determined based on an egress analysis that addresses both of the following scenarios:

1. Full building evacuation where the analysis demonstrates that the number of elevators provided for evacuation results in an evacuation time less than one hour.
2. Evacuation of the 4 consecutive floors with the highest cumulative occupant load where the analysis demonstrates that the number of elevators provided for evacuation results in an evacuation time less than 15 minutes. Floors that are not atmospherically separated are considered one floor.

A minimum of one elevator in each elevator group shall be designated for occupant evacuation. Not less than two shall be provided in each occupant evacuation elevator lobby where more than one elevator opens into the lobby. Signage shall be provided to denote which elevators are available for occupant evacuation.

403.6.2.2 Fire safety and evacuation plan. The building shall have a fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the International Fire Code. The fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators.

403.6.2.3 Operation. The occupant evacuation elevators shall be used for occupant self-evacuation in accordance with the occupant evacuation operation requirements in ASME A17.1/CAS B44 and the building's fire safety and evacuation plan.

403.6.2.4 Water protection. Lobbies serving the occupant evacuation elevator hoistways shall be protected by an *approved* method to prevent water from infiltrating into the hoistway enclosure from the activation of the *automatic sprinkler system* outside the lobbies.

403.6.2.5 Hoistway enclosure protection. Occupant evacuation elevator hoistways shall be located in shaft enclosures complying with Section 713.

403.6.2.6 Occupant evacuation elevator lobby. The occupant evacuation elevators shall open into an elevator lobby in accordance with Sections 403.6.2.6 through 403.6.2.6.6. Egress is permitted through the elevator lobby in accordance with Item 1 of Section 1016.2.

403.6.2.6.1 Access to interior exit stairway or ramp. The occupant evacuation elevator lobby shall have *direct access* from the enclosed elevator lobby to an *interior exit stairway* or *ramp*.

Exceptions:

1. Access to an *interior exit stairway* or *ramp* shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance with Section 716.2.2.1.
2. Elevators that only service an open parking garage and the lobby of the building shall not be required to provide direct access in accordance with this section.

403.6.2.6.2 Lobby enclosure. The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 403.6.2.6.3.

Exception: Enclosed occupant evacuation elevator lobbies are not required at the levels of exit discharge.

403.6.2.6.3 Lobby doorways. Other than the doors to the hoistway, elevator machine rooms, machinery spaces and control rooms within the lobby enclosure smoke barrier, each doorway to an occupant evacuation elevator lobby shall be provided with a 3/4-hour *fire door assembly* complying with Section 716.2. The *fire door assembly* shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1.1 with the UL 1784 test conducted without the artificial bottom seal.

403.6.2.6.3.1 Vision panel. A vision panel shall be installed in each *fire door assembly* protecting the lobby doorway. The vision panel shall consist of fire-protection-rated glazing and shall be located to furnish clear vision of the occupant evacuation elevator lobby.

403.6.2.6.3.2 Door closing. Each *fire door assembly* protecting the lobby doorway shall be automatic-closing upon receipt of any fire alarm signal from the *emergency voice/alarm communication system* serving the building.

403.6.2.6.4 Lobby size. Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m^2) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area also shall accommodate one wheelchair space of 30 inches by 52 inches (760 mm by 1220 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

   Exception: The size of lobbies serving multiple banks of elevators shall have the minimum floor area *approved* on an individual basis and shall be consistent with the building's fire safety and evacuation plan.

403.6.2.6.5 Signage. An *approved* sign indicating elevators are suitable for occupant self-evacuation shall be posted on all floors adjacent to each elevator call station serving occupant evacuation elevators.

403.6.2.6.6 Two-way communication system. A two-way communication system shall be provided in each occupant evacuation elevator lobby for the purpose of initiating communication with the fire command center or an alternate location *approved* by the fire department. The two-way communication system shall be designed and installed in accordance with Sections 1009.8.1 and 1009.8.2.

403.6.2.7 Elevator system monitoring. The occupant evacuation elevators shall be continuously monitored at the fire command center or a central control point *approved* by the fire department and arranged to display all of the following information:

1. Floor location of each elevator car.
2. Direction of travel of each elevator car.
3. Status of each elevator car with respect to whether it is occupied.
4. Status of normal power to the elevator equipment, elevator machinery and electrical apparatus cooling equipment where provided, elevator machine room and control room ventilation and cooling equipment.
5. Status of the *emergency power system* that provides backup power to the elevator equipment, elevator machinery and electrical cooling equipment where provided, elevator machine room and control room *ventilation* and cooling equipment.
6. Activation of any fire alarm initiating device in any elevator lobby, elevator machine room, machine space containing a motor controller or electric driving machine, control room or elevator hoistway.

403.6.2.8 Elevator recall. The fire command center or an alternate location *approved* by the fire department shall be provided with the means to manually initiate a Phase I Emergency Recall of the occupant evacuation elevators in accordance with ASME A17.1/CSA B44.

403.6.2.9 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway, and machine room and control room and that provide normal or emergency power, control signals, communication with the car, lighting, heating, air conditioning, *ventilation* and fire-detecting systems to occupant evacuation elevators shall be protected by construction having a *fire-resistance rating* of not less than 2 hours, shall be circuit integrity cable having a fire-resistance rating of not less than 2 hours or shall be protected by a listed electrical circuit protective system having a fire-resistance rating of not less than 2 hours.

Exception: Wiring and cables to control signals that do not serve Phase II emergency in-car operations are not required to be protected.

403.6.2.10 Emergency voice/alarm communication system. The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

403.6.2.10.1 Notification appliances. No fewer than one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

[S] 403.7 Signs. Signs complying with Sections 403.7.1 through 403.7.4 shall be provided in *high-rise buildings*.

403.7.1 Elevator lobbies. A sign shall be posted in every elevator lobby above each hall call fixture noting that the elevators will be recalled to the building lobby on fire alarm.

Exception: If *approved* by the *building official*, signs need not be posted in lobbies at the main egress level if the means of egress are obviously identifiable.

403.7.2 Recall floor lobbies. A sign indicating the number of each elevator shall be posted and maintained in the elevator lobby at each designated recall floor and at alternate floors of recall, if provided.

403.7.3 Stair re-entry signs. A sign shall be posted on each floor landing within a stairway indicating where re-entry is provided into the building or indicating the location of telephones or other means of two-way communication.

403.7.4 Other signs. Other signs required by this code, including but not limited to stairway identification signs required by Section 1023.9 and exit signs required by Section 1013, shall be provided.

[S] 403.8 Emergency operational plan. Prior to the issuance of a Certificate of Occupancy, the owner-occupant of the building shall assign a responsible person as the building's Fire Safety Director to establish an operational plan for the building. The operational plan shall contain the guidelines and procedures to be followed and responsibilities of the building employees and tenants under emergency conditions, including special provisions for persons with disabilities. The plan shall also include procedures for operation, maintenance and testing of the life safety systems and the allowable use and occupancy of each portion of the building. One copy of the operational plan shall be stored in the fire command center prior to issuance of the Certificate of Occupancy.

SECTION 404
ATRIUMS

404.1 General. The provisions of Sections 404.1 through 404.11 shall apply to buildings containing *atriums*. *Atriums* are not permitted in buildings or structures classified as Group H.

Exception: Vertical openings that comply with Sections 712.1.1 through 712.1.3, and Sections 712.1.9 through 712.1.14.

[S] 404.1.1 Presubmittal conference. The applicant shall arrange two presubmittal conferences with the design team, the *building official* and the *fire code official* in accordance with Sections 404.1.1.1 and 404.1.1.2. The purpose of the meeting is to obtain conceptual approval from the *building official* and the *fire code official*. The documentation of the presubmittal meeting shall be reflected on the plans for the building and become a permanent part of the Department of Construction and Inspection's records.

404.1.1.1 Atrium presubmittal conference. The applicant shall arrange an atrium presubmittal conference at least 60 days prior to submittal of a building permit application that contains the construction documents for any structural component of the building. The purpose of this presubmittal conference is to obtain conceptual approval of the design team approach to compliance with key provisions of this code related to atrium construction, excluding smoke control. The documentation of the atrium presubmittal meetings shall be reflected on the plans for the building and become a permanent part of the records of the Department of Construction and Inspections.

404.1.1.2 Smoke control presubmittal conference. The applicant shall arrange a smoke control presubmittal conference in accordance with Section 909.1.1.

404.2 Use. The floor of the *atrium* shall not be used for other than low fire hazard uses and only *approved* materials and decorations in accordance with the *International Fire Code* shall be used in the *atrium* space.

Exception: The *atrium* floor area is permitted to be used for any *approved* use where the individual space is provided with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[S][F] 404.3 Automatic sprinkler protection. An *approved automatic sprinkler system* shall be installed throughout the entire building.

Exceptions:

1. That area of a building adjacent to or above the *atrium* need not be sprinklered provided that portion of the building is separated from the *atrium* portion by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

2. Where the ceiling of the *atrium* is more than 55 feet (16 764 mm) above ((~~the floor~~)) any floor area open to the *atrium*, sprinkler protection at the ceiling of the *atrium* is not required.

[F] 404.4 Fire alarm system. A *fire alarm* system shall be provided in accordance with Section 907.2.14.

404.5 Smoke control. A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for *atriums* that connect only two *stories.*
2. A smoke control system is not required for *atriums* connecting more than two *stories* when all of the following are met:
   2.1. Only the two lowest *stories* shall be permitted to be open to the *atrium.*
   2.2. All *stories* above the lowest two *stories* shall be separated from the *atrium* in accordance with the provisions for a *shaft* in Section 713.4.

[S] 404.6 Enclosure of atriums. *Atrium* spaces shall be separated from adjacent spaces by a 1-hour *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both.

Exceptions:

1. A *fire barrier* is not required where a glass wall forming a *smoke partition* is provided. The glass wall shall comply with all of the following:
   1.1. *Automatic* sprinklers are provided along both sides of the separation wall and doors, or on the room side only if there is not a walkway on the *atrium* side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction;
   1.2. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and
   1.3. Where glass doors are provided in the glass wall, they shall be either *self-closing* or automatic-closing.
2. A *fire barrier* is not required where a glass-block wall assembly complying with Section 2110 and having a 3/4-hour *fire protection rating* is provided.
3. A *fire barrier* is not required between the *atrium* and the adjoining spaces of up to three floors of the *atrium* provided that such spaces are accounted for in the design of the smoke control system.
4. A *fire barrier* is not required between the *atrium* and the adjoining spaces where the *atrium* is not required to be provided with a smoke control system.
5. A *horizontal assembly* is not required between the *atrium* and openings for escalators complying with Section 712.1.3.
6. A *horizontal assembly* is not required between the *atrium* and openings for *exit access stairways* and *ramps* complying with Item 4 of Section 1019.3.
7. A fire barrier is not required between the atrium and the adjoining spaces for *atriums* that connect only two *stories*.

Code Alternate CA404.6: The separation between the *atrium* and tenant spaces that are not guest rooms or *dwelling units* is permitted to be omitted on four floors when:

1. The building is of Type IA or IB construction;
2. The perimeter of the opening is protected by draft curtains and a row of automatic sprinklers not more than 6 feet (1829 mm) on center as required for escalator protection;
3. All spaces of the building separated from the atrium by less than 1-hour fire-resistive construction are equipped with an automatic smoke detection system;
4. Tenant spaces open to the *atrium* have access to two *interior exit stairways* separated by one-half the building diagonal with one *exit* located so that occupants can exit in a direction away from the *atrium*. For the purpose of this requirement "away from the *atrium*" means not being forced to *exit* parallel and adjacent to the *atrium* opening. "Areas open to the *atrium*" are those areas that are not separated from the *atrium* with at least a 1-hour fire barrier.

[S][F] 404.7 ((~~Standby~~)) Emergency power system. Equipment required to provide smoke control shall be provided with ((~~standby~~)) an *emergency* power *system* in accordance with Section 909.11.

Code Alternate CA404.7: An *emergency power system* is not required for smoke control systems in buildings that have at least two *exits* and *atriums* with a total volume of less than 40,000 cubic feet (1133 m^3).

404.8 Interior finish. The *interior finish* of walls and ceilings of the *atrium* shall be not less than Class B. Sprinkler protection shall not result in a reduction in class.

404.9 Exit access travel distance. *Exit access* travel distance for areas open to an *atrium* shall comply with the requirements of Section 1017.

404.10 Exit stairways in an atrium. Where an *atrium* contains an *interior exit stairway* all the following shall be met:

1. The entry to the exit stairway is the edge of the closest riser of the exit stairway.
2. The entry of the exit stairway shall have access from a minimum of two directions.
3. The distance between the entry to an exit stairway in an atrium and the entrance to a minimum of one exit stairway enclosed in accordance with Section 1023.2 shall comply with the separation required by Section 1007.1.1.
4. Exit access travel distance shall be measured to the closest riser of the exit stairway.
5. Not more than 50 percent of the exit stairways shall be located in the same atrium.

404.11 Interior exit stairway discharge. Discharge of *interior exit stairways* through an *atrium* shall be in accordance with Section 1028.

SECTION 405
UNDERGROUND BUILDINGS

[S] 405.1 General. The provisions of Sections 405.2 through 405.9 apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the finished floor of the lowest *level of exit discharge*.

Exceptions: The provisions of Section 405 are not applicable to the following buildings or portions of buildings:

1. One- and two-family *dwellings*, sprinklered in accordance with Section 903.3.1.3.
2. Parking garages provided with *automatic sprinkler systems* in compliance with Section 405.3.
3. Fixed guideway transit systems that comply with NFPA 130 as amended.
4. *Grandstands, bleachers*, stadiums, arenas and similar facilities.
5. Where the lowest *story* is the only *story* that would qualify the building as an underground building and has an area not greater than 1,500 square feet (139 m^2) and has an *occupant load* less than 10.
6. Pumping stations and other similar mechanical spaces intended only for limited periodic use by service or maintenance personnel.

405.2 Construction requirements. The underground portion of the building shall be of Type I construction.

[F] 405.3 Automatic sprinkler system. The highest *level of exit discharge* serving the underground portions of the building and all levels below shall be equipped with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1. Water-flow switches and control valves shall be supervised in accordance with Section 903.4.

405.4 Compartmentation. Compartmentation shall be in accordance with Sections 405.4.1 through 405.4.3.

405.4.1 Number of compartments. A building having a floor level more than 60 feet (18 288 mm) below the finished floor of the lowest *level of exit discharge* shall be divided into not fewer than two compartments of approximately equal size. Such compartmentation shall extend through the highest *level of exit discharge* serving the underground portions of the building and all levels below.

Exception: The lowest *story* need not be compartmented where the area is not greater than 1,500 square feet (139 m^2) and has an *occupant load* of less than 10.

405.4.2 Smoke barrier penetration. The compartments shall be separated from each other by a *smoke barrier* in accordance with Section 709. Penetrations between the two compartments shall be limited to plumbing and electrical piping and conduit that are firestopped in accordance with Section 714. Doorways shall be protected by *fire door assemblies* that comply with Section 716, automatic-closing by smoke detection in accordance with Section 716.2.6.6 and installed in accordance with NFPA 105 and Section 716.2.2.1. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

405.4.3 Elevators. Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an enclosed elevator lobby shall be provided and shall be separated from each compartment by a *smoke barrier* in accordance with Section 709. Doorways in the *smoke barrier* shall be protected by *fire door assemblies* that comply with Section 716, shall comply with the smoke and draft control assembly requirements of

Section 716.2.2.1 with the UL 1784 test conducted without an artificial bottom seal, and shall be automatic-closing by smoke detection in accordance with Section 716.2.6.6.

[S] 405.5 Smoke control system. A smoke control system shall be provided in accordance with Sections 405.5.1 and 405.5.2. The applicant shall arrange a smoke control presubmittal conference in accordance with Section 909.1.1.

405.5.1 Control system. A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and the provisions of this section. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain *means of egress* in a usable condition.

405.5.2 Compartment smoke control system. Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with Sections 907.2.18 and 907.2.19.

[F] 405.6 Fire alarm systems. A *fire alarm* system shall be provided where required by Sections 907.2.18 and 907.2.19.

[S] 405.7 Means of egress. *Means of egress* shall be in accordance with Sections 405.7.1 and 405.7.2.

405.7.1 Number of exits. Each floor level shall be provided with not fewer than two *exits*. Where compartmentation is required by Section 405.4, each compartment shall have not fewer than one *exit* and not fewer than one *exit access* doorway into the adjoining compartment.

405.7.2 ((~~Smokeproof enclosure~~)) Smoke control in exit stairways. Every required *stairway* serving floor levels more than 30 feet (9144 mm) below the finished floor of its *level of exit discharge* shall comply with ((~~the requirements for a *smokeproof enclosure* as provided in~~)) Section 1023.12.

[S][F] 405.8 ((~~Standby and emergency~~)) Emergency power system. ((~~A *standby power system* complying with Section 2702 shall be provided for the standby power loads specified in Section 405.8.1.~~)) An *emergency power system* complying with Section 2702 shall be provided for the emergency power loads specified in Section ((~~405.8.2~~)) 405.8.1.

((~~**[F] 405.8.1 Standby power loads.** The following are classified as standby power loads:~~

1. ~~Smoke control system.~~
2. ~~*Ventilation* and *automatic* fire detection equipment for *smokeproof* enclosures.~~
3. ~~Elevators, as required in Section 3003.~~))

[F] ((~~405.8.2~~)) 405.8.1 Emergency power loads. The following are classified as emergency power loads:

1. *Emergency voice/alarm communications systems*.
2. *Fire alarm systems*.
3. *Automatic* fire detection systems.
4. Elevator car lighting.
5. *Means of egress* and *exit* sign illumination as required by Chapter 10.
6. Smoke control systems.
7. Ventilation and automatic fire detection equipment for pressurized interior exit stairways.

((~~6~~)) 8. Fire pumps.

9. Lighting for elevator cars, machine rooms, machine spaces and control rooms.
10. Ventilation and automatic fire detection equipment for pressurized stairways and elevator hoistways.
11. A selected elevator in each bank in accordance with Section 3016.9. A bank of elevators is a group of elevators or a single elevator controlled by a common operating system. All elevators that respond to a single call button constitute a bank of elevators. All elevators shall be transferable to an *emergency power system*.

Note: There is no limit on the number of cars that are permitted to be in a bank, but no more than four cars are permitted within a common hoistway. See Section 3016.10.

[F] 405.9 Standpipe system. The underground building shall be equipped throughout with a *standpipe system* in accordance with Section 905.

SECTION 406
MOTOR-VEHICLE-RELATED OCCUPANCIES

406.1 General. All motor-vehicle-related occupancies shall comply with Section 406.2. *Private garages* and carports shall also comply with Section 406.3. Open public parking garages shall also comply with Sections 406.4 and 406.5. Enclosed

public parking garages shall also comply with Sections 406.4 and 406.6. Motor fuel-dispensing facilities shall also comply with Section 406.7. *Repair garages* shall also comply with Section 406.8.

Note: The Seattle Electrical Code requires that all new parking spaces provided on a lot when a new building is constructed be "EV-ready" as defined by Seattle Municipal Code Chapter 23.84A. See Seattle Electrical Code Sections 220.57 and 625.27.

[S] 406.2 Design. *Private garages* and carports, open and enclosed public parking garages, motor fuel-dispensing facilities and *repair garages* shall comply with Sections 406.2.1 through 406.2.9.

406.2.1 Automatic garage door openers and *vehicular gates*. Automatic garage door openers shall be listed and labeled in accordance with UL 325. Where provided, *automatic vehicular gates* shall comply with Section 3110.

406.2.2 Clear height. The clear height of each floor level in vehicle and pedestrian traffic areas shall be not less than ((~~7 feet (2134 mm)~~)) 6 feet 6 inches (1981 mm). Canopies under which fuels are dispensed shall have a clear height in accordance with Section 406.7.2.

Exception: A lower clear height is permitted for a parking tier in *mechanical-access open parking garages* where approved by the *building official.*

406.2.3 Accessible parking spaces. Where parking is provided, accessible parking spaces, access aisles and vehicular routes serving accessible parking shall be provided in accordance with Section 1106.

406.2.4 Floor surfaces. Floor surfaces shall be of concrete or similar approved noncombustible and nonabsorbent materials. ((~~The area of floor used for the parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.~~)) The surface of vehicle fueling pads in motor fuel-dispensing facilities shall be in accordance with Section 406.7.1.

Exceptions:

1. Asphalt parking surfaces shall be permitted at ground level for public parking garages and private carports.
2. Slip-resistant, nonabsorbent, *interior floor finishes* having a critical radiant flux not more than 0.45 W/cm^2, as determined by ASTM E648 or NFPA 253, shall be permitted in *repair garages*.

406.2.5 Sleeping rooms. Openings between a motor vehicle-related occupancy and a room used for sleeping purposes shall not be permitted.

406.2.6 Fuel dispensing. The dispensing of fuel shall only be permitted in motor fuel-dispensing facilities in accordance with Section 406.7.

406.2.7 Electric vehicle charging stations and systems. Where provided, electric vehicle charging systems shall be installed in accordance with NFPA 70. Electric vehicle charging system equipment shall be *listed* and labeled in accordance with UL 2202. Electric vehicle supply equipment shall be *listed* and labeled in accordance with UL 2594. Accessibility to *electric vehicle charging stations* shall be provided in accordance with Section 1107.

406.2.8 Mixed occupancies and uses. Mixed uses shall be allowed in the same building as public parking garages and *repair garages* in accordance with Section 508.1. Mixed uses in the same building as an *open parking garage* are subject to Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

406.2.9 Equipment and appliances. Equipment and appliances shall be installed in accordance with Sections 406.2.9.1 through 406.2.9.3 and the *International Mechanical Code*, *International Fuel Gas Code* and NFPA 70.

406.2.9.1 Elevation of ignition sources. Equipment and appliances having an ignition source and located in hazardous locations and public garages, *private garages*, *repair garages*, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a *private garage* through openings shall be considered to be part of the *private garage.*

Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

406.2.9.1.1 Parking garages. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 406.2.9.

Exception: This section shall not apply to appliance installations complying with Section 406.2.9.2 or 406.2.9.3.

406.2.9.2 Public garages. Appliances located in public garages, motor fuel-dispensing facilities, *repair garages* or other areas frequented by motor vehicles shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehi-

2. Cooktops and ranges used for care recipient training or nutritional counseling are not required to comply with Item 3 of this section.

407.3 Corridor wall construction. *Corridor* walls shall be constructed as *smoke partitions* in accordance with Section 710.

407.3.1 Corridor doors. *Corridor* doors, other than those in a wall required to be rated by Section 509.4 or for the enclosure of a vertical opening or an *exit*, shall not have a required *fire protection rating* and shall not be required to be equipped with *self-closing* or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. Roller latches are not permitted. Other doors shall conform to Section 716.

407.3.1.1 Door construction. Doors in *corridors* not required to have a *fire protection rating* shall comply with the following:

1. Solid doors shall have close-fitting operational tolerances, head and jamb stops.
2. Dutch-style doors shall have an astragal, rabbet or bevel at the meeting edges of the upper and lower door sections. Both the upper and lower door sections shall have latching hardware. Dutch-style doors shall have hardware that connects the upper and lower sections to function as a single leaf.
3. To provide makeup air for exhaust systems in accordance with Section 1020.6, Exception 1, doors are permitted to have louvers or to have a clearance between the bottom of the door and the floor surface that is 2/3 inch (19.1 mm) maximum.

407.4 Means of egress. Group I-2 occupancies shall be provided with *means of egress* complying with Chapter 10 and Sections 407.4.1 through 407.4.4. The fire safety and evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support a *defend-in-place* emergency response in accordance with Sections 403 and 404 of the *International Fire Code*.

407.4.1 Direct access to a corridor. Habitable rooms in Group I-2 occupancies shall have an exit access door leading directly to a *corridor*.

Exceptions:

1. Rooms with *exit* doors opening directly to the outside at ground level.
2. Rooms arranged as *care suites* complying with Section 407.4.4.

407.4.1.1 Locking devices. Locking devices that restrict access to a care recipient's room from the *corridor* and that are operable only by staff from the corridor side shall not restrict the *means of egress* from the care recipient's room.

Exceptions:

1. This section shall not apply to rooms in psychiatric treatment and similar care areas.
2. Locking arrangements in accordance with Section 1010.2.14.

407.4.2 Distance of travel. The distance of travel between any point in a Group I-2 occupancy sleeping room, not located in a *care suite*, and an *exit access* door in that room shall be not greater than 50 feet (15 240 mm).

407.4.3 Projections in nursing home corridors. In Group I-2, Condition 1 occupancies, where the *corridor* width is not less than 96 inches (2440 mm), projections shall be permitted for furniture where all of the following criteria are met:

1. The furniture is attached to the floor or to the wall.
2. The furniture does not reduce the clear width of the *corridor* to less than 72 inches (1830 mm) except where other encroachments are permitted in accordance with Section 1005.7.
3. The furniture is positioned on only one side of the *corridor.*
4. Each arrangement of furniture is 50 square feet (4.6 m^2) maximum in area.
5. Furniture arrangements are separated by 10 feet (3048 mm) minimum.
6. Placement of furniture is considered as part of the fire and safety plans in accordance with Section 1002.2.

407.4.4 Group I-2 care suites. *Care suites* in Group I-2 shall comply with Sections 407.4.4.1 through 407.4.4.4 and either Section 407.4.4.5 or 407.4.4.6.

407.4.4.1 Exit access through care suites. *Exit* access from all other portions of a building not classified as a *care suite* shall not pass through a *care suite*.

[W] 407.4.4.2 Separation. *Care suites* shall be separated from other portions of the building, including other *care suites*, by a *smoke partition* complying with Section 710. Partitions within suites are not required to be smoke resistant or fire resistance rated unless required by another section of this code.

407.4.4.3 Access to corridor. Every *care suite* shall have a door leading directly to an *exit access corridor* or *horizontal exit*. Movement from habitable rooms within a *care suite* shall not require more than 100 feet (30 480 mm) of travel within the *care suite* to a door leading to the *exit access corridor* or *horizontal exit*. Where a *care suite* is required to

2. Not less than 6 square feet (0.56 m^2) for each ambulatory care recipient not confined to bed or stretcher and for other occupants.

Areas or spaces permitted to be included in the calculation of refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

407.5.4 Independent egress. A *means of egress* shall be provided from each *smoke compartment* created by *smoke barriers* without having to return through the *smoke compartment* from which *means of egress* originated. *Smoke compartments* that do not contain an *exit* shall be provided with *direct access* to not less than two adjacent *smoke compartments*.

[S] 407.5.5 Horizontal assemblies. *Horizontal assemblies* supporting *smoke barriers* required by this section shall be designed to resist the movement of smoke. Elevator lobbies shall be in accordance with Section ((~~3006.2~~)) 713.14.

407.6 Automatic-closing doors. Automatic-closing doors with hold-open devices shall comply with Sections 709.5 and 716.2.

407.6.1 Activation of automatic-closing doors. Automatic-closing doors on hold-open devices in accordance with Section 716.2.6.6 shall also close upon activation of a *fire alarm* system, an *automatic sprinkler system*, or both. The *automatic* release of the hold-open device on one door shall release all such doors within the same *smoke compartment.*

[F] 407.7 Automatic sprinkler system. *Smoke compartments* containing sleeping rooms shall be equipped throughout with an *automatic sprinkler* system in accordance with Sections 903.3.1.1 and 903.3.2.

[F] 407.8 Fire alarm system. A *fire alarm* system shall be provided in accordance with Section 907.2.6.

[F] 407.9 Automatic fire detection. *Corridors* in Group I-2, Condition 1 occupancies and spaces permitted to be open to the *corridors* by Section 407.2 shall be equipped with an *automatic* fire detection system.

Group I-2, Condition 2 occupancies shall be equipped with smoke detection as required in Section 407.2.

Exceptions:

1. Corridor smoke detection is not required where sleeping rooms are provided with *smoke detectors* that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each sleeping room and an audible and visual alarm at the care provider's station attending each unit.
2. *Corridor* smoke detection is not required where sleeping room doors are equipped with automatic door-closing devices with integral *smoke detectors* on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

407.10 Secured yards. Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m^2) for bed and stretcher care recipients and 6 net square feet (0.56 m^2) for ambulatory care recipients and other occupants are located between the building and the fence. Such provided safe dispersal areas shall be located not less than 50 feet (15 240 mm) from the building they serve.

[F] 407.11 Electrical systems. In Group I-2 occupancies, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.

SECTION 408
GROUP I-3

408.1 General. Occupancies in Group I-3 shall comply with the provisions of Sections 408.1 through 408.11 and other applicable provisions of this code (see Section 308.5).

408.2 Other occupancies. Buildings or portions of buildings in Group I-3 occupancies where security operations necessitate the locking of required *means of egress* shall be permitted to be classified as a different occupancy. Occupancies classified as other than Group I-3 shall meet the applicable requirements of this code for that occupancy where provisions are made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to requirements for detention and correctional occupancies.

Exception: It is permissible to exit through a *horizontal exit* into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a Group H use.

408.3 Means of egress. Except as modified or as provided for in this section, the *means of egress* provisions of Chapter 10 shall apply.

408.3.1 Door width. Doors to resident *sleeping units* shall have a clear width of not less than 28 inches (711 mm).

TABLE 412.2.1.1
HEIGHT LIMITATIONS FOR AIRPORT TRAFFIC CONTROL TOWERS

TYPE OF CONSTRUCTION	HEIGHT[a] (feet)
IA	Unlimited
IB	240
IIA	100
IIB	85
IIIA	65

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.
a. Height to be measured from *grade plane* to cab floor.

[BS] 412.2.1.2 Structural integrity of interior exit stairways and elevator hoistway enclosures. Enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Section 403.2.2 in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.1.3 Sprayed fire-resistant materials (SFRM). The bond strength of the SFRM installed in airport traffic control towers shall be in accordance with Section 403.2.3 where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.2 Means of egress and evacuation. The *means of egress* in airport traffic control towers shall comply with Sections 412.2.2.1 through 412.2.2.3.

[S] 412.2.2.1 Stairways. *Stairways* in airport traffic control towers shall be in accordance with Section 1011. *Exit stairways* shall be ((~~*smokeproof enclosures* complying with one of the alternatives provided in Section 909.20~~)) pressurized in accordance with Section 909.20 or 909.21.

Exception: *Stairways* in airport traffic control towers are not required to comply with Section 1011.12.

412.2.2.2 Exit access. From observation levels, airport traffic control towers shall be permitted to have a single means of *exit access* for a distance of travel not greater than 100 feet (30 480 mm). *Exit access stairways* from the observation level need not be enclosed.

412.2.2.3 Number of exits. Not less than one *exit stairway* shall be permitted for airport traffic control towers of any height provided that the *occupant load* per floor is not greater than 15 and the area per floor does not exceed 1,500 square feet (140 m^2).

412.2.2.3.1 Interior finish. Where an airport traffic control tower is provided with only one *exit stairway*, *interior wall and ceiling finishes* shall be either Class A or Class B.

412.2.2.3.2 Exit separation. Where an airport traffic control tower is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 and two *exits* are required, the exit separation distance required by Section 1007 shall be not less than one-fourth of the length of the maximum overall dimension of the area served.

[F] 412.2.3 Emergency systems. The detection, alarm and emergency systems of airport traffic control towers shall comply with Sections 412.2.3.1 through 412.2.3.3.

[F] 412.2.3.1 Automatic smoke detection systems. Airport traffic control towers shall be provided with an *automatic* smoke detection system installed in accordance with Section 907.2.22.

[F] 412.2.3.2 Fire command center. A *fire command center* shall be provided in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. The *fire command center* shall comply with Section 911.

Exceptions:

1. The *fire command center* shall be located in the airport control tower or an adjacent contiguous building where building functions are interdependent.
2. The room shall be not less than 150 square feet (14 m^2) in area with a minimum dimension of 10 feet (3048 mm).
3. The following features shall not be required in an airport traffic control tower *fire command center.*
    3.1. Emergency voice/alarm control unit.
    3.2. Public address system.
    3.3. Status indicators and controls for the air distributions centers.
    3.4. Generator supervision devices, manual start and transfer features.
    3.5. Elevator emergency or standby power switches where emergency or standby power is provided.

[F] 412.2.3.3 Smoke removal. Smoke removal in airport traffic control towers shall be provided in accordance with Section 403.4.7.

[F] 412.2.4 Automatic sprinkler system. Where an occupied floor is located more than 35 feet (10 668 mm) above the lowest level of fire department vehicle access, airport traffic control towers shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 412.2.4.1 Fire pump room. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour *fire barriers* constructed in accordance with Section 707 or 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

Exception: Separation is not required for fire pumps physically separated in accordance with NFPA 20.

[S][F] 412.2.5 Protection of elevator wiring and cables. Wiring and cables serving elevators in airport traffic control towers shall be protected in accordance with Section ((~~3007.8.1~~)) 403.6.2.9.

412.2.5.1 Elevators for occupant evacuation. Where provided in addition to an exit stairway, occupant evacuation elevators shall be in accordance with Section ((~~3008~~)) 403.6.2.

412.2.6 Accessibility. Airport traffic control towers shall be *accessible* except as specified in Section 1104.4.

412.3 Aircraft hangars. Aircraft hangars shall be in accordance with Sections 412.3.1 through 412.3.6.

412.3.1 Exterior walls. *Exterior walls* located less than 30 feet (9144 mm) from *lot lines* or a *public way* shall have a *fire-resistance rating* not less than 2 hours.

412.3.2 Basements. Where hangars have *basements*, floors over *basements* shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall not be openings or communication between *basements* and the hangar. Access to *basements* shall be from outside only.

412.3.3 Floor surface. Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

Exception: Aircraft hangars with individual lease spaces not exceeding 2,000 square feet (186 m^2) each in which servicing, repairing or washing is not conducted and fuel is not dispensed shall have floors that are graded toward the door, but shall not require a separator.

412.3.4 Heating equipment. Heating equipment shall be placed in another room separated by 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

Exceptions:

1. Unit heaters and vented infrared radiant heating equipment suspended not less than 10 feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar need not be located in a separate room provided that they are mounted not less than 8 feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. Entrance to the separated room shall be permitted by a single interior door provided that the sources of ignition in the appliances are not less than 18 inches (457 mm) above the floor.

412.3.5 Finishing. The process of "doping," involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate *detached building* equipped with *automatic fire-extinguishing equipment* in accordance with Section 903.

[F] 412.3.6 Fire suppression. Aircraft hangars shall be provided with a fire suppression system designed in accordance with NFPA 409, based on the classification for the hangar given in Table 412.3.6.

Exception: Where a *fixed base operator* has separate repair facilities on site, Group II hangars operated by a *fixed base operator* used for storage of *transient aircraft* only shall have a fire suppression system, but the system is exempt from foam requirements.

[F] TABLE 412.3.6
HANGAR FIRE SUPPRESSION REQUIREMENTS[a, b, c]

MAXIMUM SINGLE FIRE AREA (square feet)	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
≥ 40,001	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I
40,000	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
30,000	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
20,000	Group III	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II
15,000	Group III	Group III	Group III	Group II	Group III	Group II	Group III	Group II	Group II
12,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II	Group II
8,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II
5,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.
a. Aircraft hangars with a door height greater than 28 feet shall be provided with fire suppression for a Group I hangar regardless of maximum fire area.
b. Groups shall be as classified in accordance with NFPA 409.
c. Membrane structures complying with Section 3102 shall be classified as a Group IV hangar.

[F] 412.3.6.1 Hazardous operations. Any Group III aircraft hangar according to Table 412.3.6 that contains hazardous operations including, but not limited to, the following shall be provided with a Group I or II fire suppression system in accordance with NFPA 409 as applicable:

1. Doping.
2. Hot work including, but not limited to, welding, torch cutting and torch soldering.
3. Fuel transfer.
4. Fuel tank repair or maintenance not including defueled tanks in accordance with NFPA 409, inerted tanks or tanks that have never been fueled.
5. Spray finishing operations.
6. Total fuel capacity of all aircraft within the unsprinklered single *fire area* in excess of 1,600 gallons (6057 L).
7. Total fuel capacity of all aircraft within the maximum single *fire area* in excess of 7,500 gallons (28 390 L) for a hangar with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 412.3.6.2 Separation of maximum single fire areas. Maximum single *fire areas* established in accordance with hangar classification and construction type in Table 412.3.6 shall be separated by 2-hour *fire walls* constructed in accordance with Section 706. In determining the maximum single *fire area* as set forth in Table 412.3.6, ancillary uses that are separated from aircraft servicing areas by a *fire barrier* of not less than 1 hour, constructed in accordance with Section 707, shall not be included in the area.

[S] 412.3.6.3 Restrictions in the Fire District. Aircraft hangars shall not be located in the *Fire District* unless work is limited to exchange of parts and maintenance requiring no open flame or welding.

412.4 Residential aircraft hangars. *Residential aircraft hangars* shall comply with Sections 412.4.1 through 412.4.5.

412.4.1 Fire separation. A hangar shall not be attached to a *dwelling* unless separated by a *fire barrier* having a *fire-resistance rating* of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the *dwelling unit*. Doors into the *dwelling unit* shall be equipped with *self-closing* devices and conform to the requirements of Section 716 with a noncombustible raised sill not less than 4 inches (102 mm) in height. Openings from a hangar directly into a room used for sleeping purposes shall not be permitted.

412.4.2 Egress. A hangar shall provide two *means of egress*. One of the doors into the dwelling shall be considered as meeting only one of the two *means of egress*.

[F] 412.4.3 Smoke alarms. *Smoke alarms* shall be provided within the hangar in accordance with Section 907.2.22.

412.4.4 Independent systems. Electrical, mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar shall be independent of the systems installed within the dwelling. Building sewer lines shall be permitted to be connected outside the structures.

Exception: *Smoke detector* wiring and feed for electrical subpanels in the hangar.

412.4.5 Height and area limits. *Residential aircraft hangars* shall be not greater than 2,000 square feet (186 m^2) in area and 20 feet (6096 mm) in *building height*.

sions shall be made to drain such spillage away from any *exit* or *stairway* serving the helicopter landing area or from a structure housing such *exit* or *stairway*. For structural design requirements, see Section 1607.6.

[W] 412.7.3 Means of egress. The *means of egress* from *heliports*, *helipads*, and *helistops* shall comply with the provisions of Chapter 10. Landing areas located on buildings or structures shall have two or more *exits or access to exits*. For landing areas less than 60 feet (18 288 mm) in length or less than 2,000 square feet (186 m^2) in area, the second *means of egress* is permitted to be a fire escape, *alternating tread device* or ladder leading to the floor below. On Group I-2 roofs with heliports or helipads and helistops, rooftop structures enclosing exit stair enclosures or elevator shafts shall be enclosed with fire barriers and opening protectives that match the rating of their respective shaft enclosures below.

[F] 412.7.4 Rooftop heliports and helistops. Rooftop *heliports* and *helistops* shall comply with NFPA 418.

[F] 412.7.5 Standpipe system. In buildings equipped with a *standpipe system*, the standpipe shall extend to the roof level in accordance with Section 905.3.6.

[S] 412.7.6 Restrictions in the Fire District. Heliports shall not be located in the *Fire District*.

SECTION 413
COMBUSTIBLE STORAGE

413.1 General. High-piled stock or rack storage in any occupancy group shall comply with the *International Fire Code*.

413.2 Attic, under-floor and concealed spaces. *Attic*, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are *self-closing* and are of noncombustible construction or solid wood core not less than 1-3/4 inches (45 mm) in thickness.

Exception: Neither fire-resistance-rated construction nor opening protectives are required in any of the following locations:

1. Areas protected by *approved automatic sprinkler systems*.
2. Group R-3 and U occupancies.

[S] 413.3 Mini-storage warehouses. In mini-storage warehouse buildings, individual storage lockers shall be separated from each other with fire partitions.

Exception: The separation between individual storage lockers is permitted to be non-rated in rooms 500 square feet (46 m^2) or less in area and in sprinklered rooms of any size.

[S] 413.4 Basement storage and sale of combustible materials. Storage and sale of combustible material in basements shall be in accordance with Sections 413.4.1 through 413.4.5.

Exception: Areas protected with an *approved automatic sprinkler system* that are separated from other areas in the basement by fire barriers with at least a one-hour fire resistance rating are not required to comply with this section.

413.4.1 Storage room size. Combustible material being stored or available for sales shall be placed in rooms no larger than 500 square feet (46.5 m^2).

413.4.2 Storage room construction. Each storage room shall be separated from other areas by fire barriers with at least a one hour fire-resistance rating.

413.4.3 Number of storage rooms. There shall be a maximum of three storage rooms within any one basement.

413.4.4 Storage room access. Each storage room shall be provided with access directly from the building exterior, or through a one-hour fire resistance rated corridor between each room and an exterior door or *exit* enclosure.

413.4.5 Storage room restrictions. Storage rooms shall not contain any material classified as a flammable liquid, hazardous material, or highly combustible material.

SECTION 414
HAZARDOUS MATERIALS

[F] 414.1 General. The provisions of Sections 414.1 through 414.6 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of *hazardous materials.*

[F] 414.1.1 Other provisions. Buildings and structures with an occupancy in Group H shall comply with this section and the applicable provisions of Section 415 and the *International Fire Code*.

[F] 414.1.2 Materials. The safe design of hazardous material occupancies is material dependent. Individual material requirements are found in Sections 307 and 415, the *International Mechanical Code* and the *International Fire Code*.

[F] 414.1.2.1 Aerosol products, aerosol cooking spray products and plastic aerosol 3 products. Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 products shall be stored and displayed in accordance with the *International Fire Code*. See Section 311.2 and the *International Fire Code* for occupancy group requirements.

[F] 414.1.3 Information required. A report shall be submitted to the *building official* identifying the maximum expected quantities of *hazardous materials* to be stored, used in a *closed system* and used in an *open system*, and subdivided to separately address *hazardous material* classification categories based on Tables 307.1(1) and 307.1(2). The methods of protection from such hazards, including but not limited to *control areas*, fire protection systems and Group H occupancies shall be indicated in the report and on the *construction documents*. The opinion and report shall be prepared by a qualified person, firm or corporation *approved* by the *building official* and provided without charge to the enforcing agency.

For buildings and structures with an occupancy in Group H, separate floor plans shall be submitted identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure.

414.1.4 Presubmittal conference. Prior to application for a permit for a Group H-5 Occupancy, the applicant shall arrange a presubmittal conference with the design team, the *building official* and *fire code official* to review the proposed emergency life safety systems for the building and the appropriate protection of the life safety systems. For Group H-4 occupancies, a presubmittal conference is recommended. The purpose of the meeting is to obtain conceptual approval from the *building official* and the *fire code official* of the proposed systems.

Applicants shall bring to the conference preliminary building plans and a draft of the Hazardous Materials Management Plan. The building permit shall not be issued until the *building official* and *fire code official* have *approved*, in writing, the emergency life safety systems for the building and the protection of the life safety systems. The documentation of the presubmittal meeting shall be reflected on the plans for the building and become a permanent part of the Department of Construction and Inspection's records.

414.1.5 Hazardous material areas in buildings over 420 feet in building height. In buildings in which an occupant evacuation elevator is used to comply with Section 403.6.2, no building areas shall contain hazardous materials exceeding the maximum allowable quantities per *control area* as addressed in Section 414.2.

[S][F] 414.2 Control areas. *Control areas* shall comply with Sections 414.2.1 through 414.2.5 and the *International Fire Code*.

Exception: *Higher education laboratories* in accordance with Section 428 and Chapter 38 of the *International Fire Code*.

[F] 414.2.1 Construction requirements. *Control areas* shall be separated from each other by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 414.2.2 Percentage of maximum allowable quantities. The percentage of maximum allowable quantities of *hazardous materials* per *control area* permitted at each floor level within a building shall be in accordance with Table 414.2.2.

Exception: *Non-production laboratory facilities* are permitted to be in accordance with Section 414.7.

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

STORY		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[a]	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[b]
Above grade plane	Higher than 9	5	1	2
	7–9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.

b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

[F] 414.2.3 Number. The maximum number of *control areas* within a building shall be in accordance with Table 414.2.2. For the purposes of determining the number of *control areas* within a building, each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered a separate building.

Exception: *Non-production laboratory facilities* are permitted to be in accordance with Section 414.7.

[F] 414.2.4 Fire-resistance rating requirements. The required *fire-resistance rating* for *fire barriers* shall be in accordance with Table 414.2.2 or Table 414.7 for *non-production laboratory facilities*. The floor assembly of the *control area* and the construction supporting the floor of the *control area* shall have a *fire-resistance rating* of not less than 2 hours.

Exception: The floor assembly of the *control area* and the construction supporting the floor of the *control area* are allowed to be 1-hour fire-resistance-rated in buildings of Types IIA, IIIA, IV and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
2. The building is three or fewer *stories above grade plane*.

[F] 414.2.5 Hazardous material in Group M display and storage areas and in Group S storage areas. *Hazardous materials* located in Group M and Group S occupancies shall be in accordance with Sections 414.2.5.1 through 414.2.5.3.

[F] 414.2.5.1 Nonflammable solids and nonflammable and noncombustible liquids. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single *control area* of a Group M display and storage area, a Group S storage area or an outdoor *control area* is permitted to exceed the maximum allowable quantities per *control area* specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *International Fire Code* and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

[F] TABLE 414.2.5(1)
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES OF NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS[d, e, f]

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material[a]	Class	Solids (pounds)	Liquids (gallons)
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
1. Corrosives[b, c]	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20[b, c]	2[b, c]
3. Toxics[b, c]	Not Applicable	1,000[k]	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers[b, c]	4	Not Allowed	Not Allowed
	3	1,350[g]	115
	2	2,250[h]	225
	1	18,000[i, j]	1,800[i, j]
2. Unstable (reactives)[b, c]	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3[b, c]	550	55
	2[b, c]	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. Hazard categories are as specified in the *International Fire Code*.

b. Maximum allowable quantities shall be increased 100 percent in buildings that are sprinklered in accordance with Section 903.3.1.1. Where Note c also applies, the increase for both notes shall be applied accumulatively.

c. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, in accordance with the *International Fire Code*. Where Note b also applies, the increase for both notes shall be applied accumulatively.

d. See Table 414.2.2 for design and number of control areas.

e. Allowable quantities for other hazardous material categories shall be in accordance with Section 307.

f. Maximum quantities shall be increased 100 percent in outdoor control areas.

g. Maximum amounts shall be increased to 2,250 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

h. Maximum amounts shall be increased to 4,500 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

i. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
j. Quantities are unlimited in an outdoor control area.
k. Maximum allowable quantities of consumer products shall be increased to 10,000 pounds where individual packages are in the original, sealed containers from the manufacturer and the toxic classification is exclusively based on the LC threshold and no other hazardous materials classifications apply.

[F] 414.2.5.2 Flammable and combustible liquids. In Group M occupancy wholesale and retail sales uses, indoor storage of *flammable and combustible liquids* shall not exceed the maximum allowable quantities per *control area* as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the *International Fire Code*.

[F] TABLE 414.2.5(2)
MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA[a]

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with Note b densities and arrangements	Sprinklered in accordance with Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1 of the *International Fire Code*	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500[c]	15,000[c]	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m^2.

a. Control areas shall be separated from each other by not less than a 1-hour *fire barrier* wall.
b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:
   1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.
   2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.
c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to not more than 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

[F] 414.2.5.3 Aerosol products, aerosol cooking spray products or plastic aerosol 3 products. The maximum quantity of *aerosol products*, aerosol cooking spray products or plastic aerosol 3 products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the *International Fire Code*.

[F] 414.3 Ventilation. Rooms, areas or spaces in which *explosive, corrosive, combustible, flammable or highly toxic* dusts, mists, fumes, vapors or gases are or have the potential to be emitted due to the processing, *use*, handling or storage of materials shall be mechanically ventilated where required by this code, the *International Fire Code* or the *International Mechanical Code*.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *International Fire Code* and the *International Mechanical Code*.

[F] 414.4 Hazardous material systems. Systems involving *hazardous materials* shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. *Automatic* controls, where provided, shall be designed to be fail safe.

[S][F] 414.5 Inside storage, dispensing and use. The inside storage, dispensing and *use* of *hazardous materials* shall be in accordance with Sections 414.5.1 through 414.5.3 of this code and the *International Fire Code*.

[F] 414.5.1 Explosion control. *Explosion* control shall be provided in accordance with the *International Fire Code* as required by Table 414.5.1 where quantities of *hazardous materials* specified in that table exceed the maximum allowable quantities in Table 307.1(1) or where a structure, room or space is occupied for purposes involving *explosion* hazards as required by Section 415 or the *International Fire Code*.

[F] TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS[a, h]

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems[b]
HAZARD CATEGORY			
Combustible dusts[c]	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA[d]	Not Required	Required
	IB[e]	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2[g]	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Electrochemical energy storage system[i]	—	Not Required	Required
Energy storage system[i]	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist[f]	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

a. See Section 414.1.3.
b. See the International Fire Code.
c. Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.8.2 of the International Fire Code. See definition of "Combustible dust" in Chapter 2.
d. Storage or use.
e. In open use or dispensing.
f. Rooms containing dispensing and use of hazardous materials where an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.
g. A method of explosion control shall be provided where Class 2 water-reactive materials can form potentially explosive mixtures.
h. Explosion venting is not required for Group H-5 fabrication areas complying with Section 415.11.1 and the International Fire Code.
i. Where explosion control is required in Section 1207 of the *International Fire Code*.

[F] 414.5.2 Emergency or standby power. Where required by the *International Fire Code* or this code, mechanical *ventilation*, treatment systems, temperature control, alarm, detection or other electrically operated systems shall be provided with emergency or legally required standby power in accordance with Section 2702 and the *International Fire Code*. For storage and use areas for *highly toxic or toxic* materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the *International Fire Code*.

[F] 414.5.2.1 Exempt applications. Emergency or standby power is not required for the mechanical *ventilation* systems provided for any of the following:

1. Storage of Class IB and IC flammable and combustible liquids in closed containers not exceeding 6.5 gallons (25 L) capacity.

2. Storage of Class 1 and 2 oxidizers.
3. Storage of Class II, III, IV and V organic peroxides.
4. Storage of asphyxiant, irritant and radioactive gases.

[F] 414.5.2.2 Fail-safe engineered systems. Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

[F] 414.5.3 Spill control, drainage and containment. Rooms, buildings or areas occupied for the storage of solid and liquid *hazardous materials* shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *International Fire Code*. The methods of spill control shall be in accordance with the *International Fire Code*.

[F] 414.6 Outdoor storage, dispensing and use. The outdoor storage, dispensing and use of *hazardous materials* shall be in accordance with the *International Fire Code*.

[F] 414.6.1 Weather protection. Where weather protection is provided for sheltering outdoor *hazardous material* storage or use areas, such areas shall be considered outdoor storage or *use* where the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.

[F] 414.6.1.1 Walls. Walls shall not obstruct more than one side of the structure.

Exception: Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area is not greater than 25 percent of the structure's perimeter.

[F] 414.6.1.2 Separation distance. The distance from the structure to buildings, *lot lines*, *public ways* or *means of egress* to a *public way* shall be not less than the distance required for an outside *hazardous material* storage or use area without weather protection.

[F] 414.6.1.3 Noncombustible construction. The overhead structure shall be of *approved* noncombustible construction with a maximum area of 1,500 square feet (140 m^2).

Exception: The maximum area is permitted to be increased as provided by Section 506.

[S] 414.7 Non-production laboratory facilities. *Non-production laboratory facilities* are permitted to comply with Sections 414.7.1 through 414.7.4.

414.7.1 Maximum allowable quantity per control area. The aggregate amount of hazardous materials in a *control area* shall not exceed the percentage specified in Table 414.7.

414.7.2 Fire-resistance-rating requirements. The required fire-resistance rating for fire barriers shall be in accordance with Table 414.7 for *non-production laboratory facilities*.

414.7.3 Storage. Storage in control areas shall be in accordance with this code and Sections 414.7.3.1 through 414.7.3.2.

414.7.3.1 Density. Storage of Class I flammable liquids shall not exceed 4 gallons per 100 square feet (0.13 L/m^2) of floor area above floor level 6.

414.7.3.2 Container size. Individual containers in storage shall not exceed 1 gallon (3.8 L) for Class I flammable liquids.

414.7.4 Automatic sprinkler system. An *approved automatic sprinkler system* shall be installed throughout a building containing a *non-production laboratory facility*. The sprinkler system shall be designed to protect an ordinary hazard group 2 occupancy.

[S] TABLE 414.7
DESIGN AND NUMBER OF CONTROL AREAS IN NON-PRODUCTION LABORATORY FACILITIES[a]

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[b]	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[c, d]
Above Grade Plane	Higher than 20	Not Allowed	Not Allowed	Not Allowed
	6-20	15	2	2
	5	25	2	2
	4	25	2	2
	3	50	2	2
	2	75	2	1
	1	100	2	1
Below Grade Plane	1	75	2	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Table 414.7 applies to *non-production laboratory facilities* meeting the criteria of Section 414.7.
b. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2) with all increases allowed in the footnotes to those tables.
c. Fire barriers shall include walls and floors as necessary to provide separation from other portions of the building.
d. Vertical fire barriers separating control areas from other spaces on the same floor may be one-hour rated.

SECTION 415
GROUPS H-1, H-2, H-3, H-4 AND H-5

[F] 415.1 General. The provisions of Sections 415.1 through 415.11 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per *control area* listed in Section 307.1.

[F] 415.2 Compliance. Buildings and structures with an occupancy in Group H shall comply with the applicable provisions of Section 414 and the *International Fire Code*.

[F] 415.3 Automatic fire detection systems. Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.

[F] 415.4 Automatic sprinkler system. Group H occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.5.

[F] 415.5 Emergency alarms. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

[F] 415.5.1 Storage. An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior *exit* or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

[F] 415.5.2 Dispensing, use and handling. Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through *corridors*, *interior exit stairways* or *ramps*, or exit passageways, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and *exit access doorway* throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall initiate a local audible alarm.

[F] 415.5.3 Supervision. Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be electrically supervised and monitored by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

[F] 415.5.4 Emergency alarm systems. *Emergency alarm systems* required by Section 415.5.1 or 415.5.2 shall be provided with emergency or standby power in accordance with Section 2702.2.

[F] 415.6 Fire separation distance. Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an *exterior wall*.

[F] 415.6.1 Rooms for flammable or combustible liquid use, dispensing or mixing in open systems. Rooms for *flammable or combustible liquid use*, dispensing or mixing in open systems having a floor area of not more than 500 square feet (46.5 m^2) need not be located on the outer perimeter of the building where they are in accordance with the *International Fire Code* and NFPA 30.

[F] 415.6.2 Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems. *Liquid storage rooms* and rooms for *flammable or combustible liquid use* in closed systems, having a floor area of not more than 1,000 square feet (93 m^2) need not be located on the outer perimeter where they are in accordance with the *International Fire Code* and NFPA 30.

[F] 415.6.3 Spray paint booths. Spray paint booths that comply with the *International Fire Code* need not be located on the outer perimeter.

[S][F] 415.6.4 Group H occupancy minimum fire separation distance. Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the *minimum fire separation distance* as set forth in Sections 415.6.4.1 through 415.6.4.4. Distances shall be measured from the walls enclosing the occupancy to *lot lines*, including those on a public way. Distances to assumed *lot lines* established for the purpose of determining *exterior wall* and opening protection are not to be used to establish the minimum *fire separation distance* for buildings on sites where explosives are manufactured or used where separation is provided in accordance with the quantity distance tables specified for *explosive* materials in the *International Fire Code*.

[F] 415.6.4.1 Group H-1. Group H-1 occupancies shall be set back not less than 75 feet (22 860 mm) and not less than required by the *International Fire Code*.

((~~**Exception:** *Fireworks* manufacturing buildings separated in accordance with NFPA 1124.~~))

415.6.4.1.1 Restrictions in the Fire District. Group H-1 occupancies shall not be located in the *Fire District*.

[F] 415.6.4.2 Group H-2. Group H-2 occupancies shall be set back not less than 30 feet (9144 mm) where the area of the occupancy is greater than 1,000 square feet (93 m^2) and it is not required to be located in a *detached building*.

415.6.4.2.1 Restrictions in the Fire District. Group H-2 occupancies having a floor area in excess of 500 square feet (46 m^2) are not permitted in the *Fire District*. Group H-3 occupancies having a floor area in excess of 1,500 square feet (139 m^2) are not permitted in the *Fire District*.

[F] 415.6.4.3 Groups H-2 and H-3. Group H-2 and H-3 occupancies shall be set back not less than 50 feet (15 240 mm) where a *detached building* is required (see Table 415.6.5).

[F] 415.6.4.4 Explosive materials. Group H-2 and H-3 occupancies containing materials with *explosive* characteristics shall be separated as required by the *International Fire Code*. Where separations are not specified, the distances required shall be determined by a technical report issued in accordance with Section 414.1.3.

[F] 415.6.5 Detached buildings for Group H-1, H-2 or H-3 occupancy. The storage or use of hazardous materials in excess of those amounts specified in Table 415.6.5 shall be in accordance with the applicable provisions of Sections 415.7 and 415.8.

[F] 415.6.5.1 Wall and opening protection. Where a *detached building* is required by Table 415.6.5, wall and opening protection based on *fire separation distance* is not required.

[F] TABLE 415.6.5
DETACHED BUILDING REQUIRED

A DETACHED BUILDING IS REQUIRED WHERE THE QUANTITY OF MATERIAL EXCEEDS THAT SPECIFIED HEREIN			
Material	**Class**	**Solids and Liquids (tons)[a, b]**	**Gases (cubic feet)[a, b]**
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4[c]	1	
	Division 1.5	Maximum Allowable Quantity	
	Division 1.6	Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II	25	Not Applicable
	Class III	50	Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrophoric gases[d]	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m^3, 1 pound = 0.454 kg.

a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Section 415.6 of this code or Chapter 56 of the *International Fire Code* based on trinitrotoluene (TNT) equivalence of the material, whichever is greater.

b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 307.1(1).

c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, provided that the net explosive weight of individual articles does not exceed 1 pound.

d. Detached buildings are not required, for gases in gas rooms that support H-5 fabrication facilities where the gas room is separated from other areas by a fire barrier with a fire-resistance rating of not less than 2 hours and the gas is located in a gas cabinet that is internally sprinklered, equipped with continuous leak detection, automatic shutdown and is not manifolded upstream of pressure controls. Additionally, the gas supply is limited to cylinders that do not exceed 125 pounds (57 kg) water capacity in accordance with 49 CFR 173.192 for Hazard Zone A toxic gases.

[F] 415.9.1.6 Tank vent. Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the *International Fire Code*.

[F] 415.9.1.7 Room ventilation. Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical *ventilation*. The mechanical *ventilation* system shall be in accordance with the *International Mechanical Code* and the *International Fire Code*.

[F] 415.9.1.8 Explosion venting. Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *International Fire Code*.

[F] 415.9.1.9 Tank openings other than vents. Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.

[F] 415.9.2 Liquefied petroleum gas facilities. The construction and installation of liquefied petroleum gas facilities shall be in accordance with the requirements of this code, the *International Fire Code*, the *International Fuel Gas Code*, the *International Mechanical Code* and NFPA 58.

[S][F] 415.9.3 Dry cleaning plants. The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, the *International Mechanical Code*, the ((~~*International*~~)) *Uniform Plumbing Code* and NFPA 32. Dry cleaning solvents and systems shall be classified in accordance with the *International Fire Code*.

[F] 415.10 Groups H-3 and H-4. Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the *International Fire Code*.

[F] 415.10.1 Flammable and combustible liquids. The storage, handling, processing and transporting of flammable and combustible liquids in Group H-3 occupancies shall be in accordance with Section 415.9.1.

[F] 415.10.2 Gas rooms. Where gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 415.10.3 Floors in storage rooms. Floors in storage areas for *corrosive* liquids and *highly toxic* or toxic materials shall be of liquid-tight, noncombustible construction.

[F] 415.10.4 Separation of highly toxic solids and liquids. *Highly toxic* solids and liquids not stored in *approved* hazardous materials storage cabinets shall be isolated from other hazardous materials storage by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 415.11 Group H-5. In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Sections 415.11.1 through 415.11.12 and the *International Fire Code*.

[F] 415.11.1 Fabrication areas. *Fabrication areas* shall comply with Sections 415.11.1.1 through 415.11.1.8.

[F] 415.11.1.1 Hazardous materials. Hazardous materials and hazardous production materials (HPM) shall comply with Sections 415.11.1.1.1 and 415.11.1.1.2.

[F] 415.11.1.1.1 Aggregate quantities. The aggregate quantities of hazardous materials stored and used in a single *fabrication area* shall not exceed the quantities set forth in Table 415.11.1.1.1.

Exception: The quantity limitations for any hazard category in Table 415.11.1.1.1 shall not apply where the *fabrication area* contains quantities of hazardous materials not exceeding the maximum allowable quantities per *control area* established by Tables 307.1(1) and 307.1(2).

c. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
d. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed the greater of 0.2 cubic feet at NTP/square foot or 9,000 cubic feet at NTP.
e. The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.6.5.
f. Quantity of Class 3 water-reactive solids in a single tool shall not exceed 1 pound.

[F] 415.11.1.1.2 Hazardous production materials. The maximum quantities of hazardous production materials (HPM) stored in a single *fabrication area* shall not exceed the maximum allowable quantities per *control area* established by Table 307.1(1) and Table 307.1(2).

[F] 415.11.1.2 Separation. *Fabrication areas*, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.11.1.1.1, shall be separated from each other, from *corridors* and from other parts of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Exceptions:

1. Doors within such *fire barrier* walls, including doors to *corridors*, shall be only *self-closing fire door assemblies* having a *fire protection rating* of not less than 3/4 hour.
2. Windows between *fabrication areas* and *corridors* are permitted to be fixed glazing *listed* and labeled for a *fire protection rating* of not less than 3/4 hour in accordance with Section 716.

[F] 415.11.1.3 Location of occupied levels. Occupied levels of *fabrication areas* shall be located at or above the first *story above grade plane*.

[F] 415.11.1.4 Floors. Except for surfacing, floors within *fabrication areas* shall be of noncombustible construction.

Openings through floors of *fabrication areas* are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such *fabrication areas* (see Section 415.11.1.5).

Floors forming a part of an occupancy separation shall be liquid tight.

[F] 415.11.1.5 Shafts and openings through floors. Elevator hoistways, vent *shafts* and other openings through floors shall be enclosed where required by Sections 712 and 713. Mechanical, duct and piping penetrations within a *fabrication area* shall not extend through more than two floors. The *annular space* around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The *fabrication area*, including the areas through which the ductwork and piping extend, shall be considered to be a single conditioned environment.

[F] 415.11.1.6 Ventilation. Mechanical exhaust *ventilation* at the rate of not less than 1 cubic foot per minute per square foot [0.0051 $m^3/(s \times m^2)$] of floor area shall be provided throughout the portions of the *fabrication area* where HPM are used or stored. The exhaust air duct system of one *fabrication area* shall not connect to another duct system outside that *fabrication area* within the building.

A *ventilation* system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

Two or more operations at a *workstation* shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711 shall be contained in a *shaft* of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate *fire walls*.

Fire dampers shall not be installed in exhaust ducts.

[F] 415.11.1.7 Transporting hazardous production materials to fabrication areas. HPM shall be transported to *fabrication areas* through enclosed piping or tubing systems that comply with Section 415.11.7, through *service corridors* complying with Section 415.11.3, or in *corridors* as permitted in the exception to Section 415.11.2. The handling or transporting of HPM within *service corridors* shall comply with the *International Fire Code*.

[S][F] 415.11.1.8 Electrical. Electrical equipment and devices within the *fabrication area* shall comply with ((~~NFPA 70~~)) the *Seattle Electrical Code*. The requirements for hazardous locations need not be applied where the average air change is not less than four times that set forth in Section 415.11.1.6 and where the number of air changes at any location is not less than three times that required by Section 415.11.1.6. The use of recirculated air shall be permitted.

[F] 415.11.1.8.1 Workstations. Workstations shall not be energized without adequate exhaust *ventilation*. See Section 415.11.1.6 for workstation exhaust *ventilation requirements*.

[F] 415.11.2 Corridors. *Corridors* shall comply with Chapter 10 and shall be separated from *fabrication areas* as specified in Section 415.11.1.2. *Corridors* shall not contain HPM and shall not be used for transporting such materials except through closed piping systems as provided in Section 415.11.7.4.

[F] 415.11.8.2.2 Shutoff of gas supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas detection sampling point initiating the gas detection system alarm is within a *gas cabinet* or *exhausted enclosure*, the shutoff valve in the *gas cabinet* or *exhausted enclosure* for the specific gas detected shall automatically close.
2. Where the gas detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an *exhausted enclosure*, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception: Where the gas detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

[F] 415.11.9 Manual fire alarm system. An *approved* manual *fire alarm* system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the *emergency control station*. The *fire alarm* system shall be designed and installed in accordance with Section 907.

[F] 415.11.10 Emergency control station. An *emergency control station* shall be provided in accordance with Sections 415.11.10.1 through 415.11.10.3.

[F] 415.11.10.1 Location. The *emergency control station* shall be located on the premises at an *approved* location outside the *fabrication area*.

[F] 415.11.10.2 Staffing. Trained personnel shall continuously staff the *emergency control station*.

[F] 415.11.10.3 Signals. The *emergency control station* shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. *Automatic sprinkler system* alarm and monitoring systems.
2. Manual *fire alarm* systems.
3. *Emergency alarm systems*.
4. *Gas detection systems*.
5. Smoke detection systems.
6. Emergency power system.
7. Automatic detection and alarm systems for *pyrophoric* liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *International Fire Code*.
8. Exhaust *ventilation* flow alarm devices for *pyrophoric* liquids and Class 3 water-reactive liquids cabinet exhaust *ventilation* systems required in Section 2705.2.3.4 of the *International Fire Code*.

[F] 415.11.11 Emergency power system. An emergency power system shall be provided in Group H-5 occupancies in accordance with Section 2702. The emergency power system shall supply power automatically to the electrical systems specified in Section 415.11.11.1 when the normal electrical supply system is interrupted.

[S][F] 415.11.11.1 Required electrical systems. ((~~Emergency~~)) An *emergency* power *system* shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust *ventilation systems*.
2. HPM *gas cabinet ventilation systems*.
3. HPM *exhausted enclosure ventilation systems*.
4. HPM *gas room ventilation systems*.
5. HPM gas detection systems.
6. *Emergency alarm systems*.
7. Manual and automatic *fire alarm systems*.
8. *Automatic sprinkler system* monitoring and alarm systems.
9. Automatic alarm and detection systems for *pyrophoric* liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *International Fire Code*.

SECTION 417
DRYING ROOMS

[F] 417.1 General. A drying room or dry kiln installed within a building shall be constructed entirely of *approved* noncombustible materials or assemblies of such materials regulated by the *approved* rules or as required in the general and specific sections of this chapter for special occupancies and where applicable to the general requirements of the *International Mechanical Code*.

[F] 417.2 Piping clearance. Overhead heating pipes shall have a clearance of not less than 2 inches (51 mm) from combustible contents in the dryer.

[F] 417.3 Insulation. Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with 1/4-inch (6.4 mm) insulating mill board or other approved equivalent insulation.

[F] 417.4 Fire protection. Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4, shall be protected by an *approved automatic fire-extinguishing system* complying with the provisions of Chapter 9.

SECTION 418
ORGANIC COATINGS

[F] 418.1 Building features. Manufacturing of organic coatings shall be done only in buildings that do not have pits or *basements.*

[F] 418.2 Location. Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

[F] 418.3 Process mills. Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a *detached building* or noncombustible structure.

[F] 418.4 Tank storage. Storage areas for *flammable and combustible liquid* tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 418.5 Nitrocellulose storage. Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 418.6 Finished products. Storage rooms for finished products that are *flammable or combustible liquids* shall be separated from the processing area by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

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SECTION 419
ARTIFICIAL DECORATIVE VEGETATION

[F] 419.1 Artificial decorative vegetation. Artificial decorative vegetation exceeding 6 feet (1830 mm) in height and permanently installed outdoors within 5 feet (1524 mm) of a building, or on the roof of a building, shall comply with Section 321.1 of the *International Fire Code.*

Exception: Artificial decorative vegetation located more than 30 feet (9144 mm) from the exterior wall of a building.

SECTION 420
GROUPS I-1, R-1, R-2, R-3 AND R-4

[S] 420.1 General. Occupancies in Groups I-1, R-1, R-2, R-3 and R-4 shall comply with the provisions of Sections 420.1 through ((~~420.11~~)) 420.15 and other applicable provisions of this code.

[W] 420.2 Separation walls. Walls separating *dwelling units* in the same building, walls separating *sleeping units* in the same building and walls separating *dwelling* or *sleeping units* from other occupancies contiguous to them in the same building shall be constructed as *fire partitions* in accordance with Section 708. Buildings containing multiple sleeping units with common use or central kitchens shall not be classified as a single dwelling.

➡

Interpretation I420: Separation provisions of Section 508 apply in addition to the separation requirements of Section 420.

420.3 Horizontal separation. Floor assemblies separating *dwelling units* in the same buildings, floor assemblies separating *sleeping units* in the same building and floor assemblies separating dwelling or *sleeping units* from other occupancies contiguous to them in the same building shall be constructed as *horizontal assemblies* in accordance with Section 711.

[F] 420.4 Automatic sprinkler system. Group R occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.8. Group I-1 occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.6. Quick-response or residential *automatic* sprinklers shall be installed in accordance with Section 903.3.2.

[F] 420.5 Fire alarm systems and smoke alarms. *Fire alarm* systems and smoke alarms shall be provided in Group I-1, R-1 and R-2 occupancies in accordance with Sections 907.2.6, 907.2.8 and 907.2.9, respectively. Single- or multiple-station smoke alarms shall be provided in Groups I-1, R-2, R-3 and R-4 in accordance with Section 907.2.11.

420.6 Smoke barriers in Group I-1, Condition 2. *Smoke barriers* shall be provided in Group I-1, Condition 2 to subdivide every *story* used by persons receiving care, treatment or sleeping and to provide other *stories* with an *occupant load* of 50 or more persons, into not fewer than two *smoke compartments*. Such *stories* shall be divided into *smoke compartments* with an area of not more than 22,500 square feet (2092 m^2) and the distance of travel from any point in a *smoke compartment* to a *smoke barrier* door shall not exceed 200 feet (60 960 mm). The *smoke barrier* shall be in accordance with Section 709.

420.6.1 Refuge area. Refuge areas shall be provided within each *smoke compartment*. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining *smoke compartment.* Where a *smoke compartment* is adjoined by two or more *smoke compartments*, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 15 net square feet (1.4 m^2) for each care recipient.
2. Not less than 6 net square feet (0.56 m^2) for other occupants.

Areas or spaces permitted to be included in the calculation of the refuge area are corridors, lounge or dining areas and other low-hazard areas.

420.7 Group I-1 assisted living housing units. In Group I-1 occupancies, where a *fire-resistance corridor* is provided in areas where assisted living residents are housed, shared living spaces, group meeting or multipurpose therapeutic spaces open to the *corridor* shall be in accordance with all of the following criteria:

1. The walls and ceilings of the space are constructed as required for *corridors*.
2. The spaces are not occupied as resident sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
3. The open space is protected by an *automatic* fire detection system installed in accordance with Section 907.
4. In Group I-1, Condition 1, the *corridors* onto which the spaces open are protected by an *automatic* fire detection system installed in accordance with Section 907, or the spaces are equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
5. In Group I-1, Condition 2, the *corridors* onto which the spaces open, in the same *smoke compartment*, are protected by an *automatic* fire detection system installed in accordance with Section 907, or the *smoke compartment* in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
6. The space is arranged so as not to obstruct access to the required *exits*.

420.8 Group I-1 cooking facilities. In Group I-1 occupancies, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted to be open to the *corridor* where all of the following criteria are met:

1. In Group I-1, Condition 1 occupancies, the number of care recipients served by one cooking facility shall not be greater than 30.
2. In Group I-1, Condition 2 occupancies, the number of care recipients served by one cooking facility and within the same *smoke compartment* shall not be greater than 30.
3. The space containing the cooking facilities shall be arranged so as not to obstruct access to the required *exit.*
4. The cooking appliances shall comply with Section 420.9.

420.9 Domestic cooking appliances. In Group I-1 occupancies, installation of cooking appliance used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the International Mechanical Code shall be provided over cooktops or ranges.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.

4. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

Exceptions:

1. Cooking facilities provided within care recipients' individual dwelling units are not required to comply with this section.
2. Cooktops and ranges used for care-recipient training or nutritional counseling are not required to comply with Item 3 of this section

420.10 Group R cooking facilities. In Group R occupancies, cooking appliances used for domestic cooking operations shall be in accordance with Section 917.2 of the *International Mechanical Code*.

420.11 Group R-2 dormitory cooking facilities. Domestic cooking appliances for use by residents of Group R-2 college *dormitories* shall be in accordance with Sections 420.11.1 and 420.11.2.

420.11.1 Cooking appliances. Where located in Group R-2 college *dormitories*, domestic cooking appliances for use by residents shall be in compliance with all of the following:

1. The types of domestic cooking appliances shall be limited to ovens, cooktops, ranges, warmers, coffee makers and microwaves.
2. Domestic cooking appliances shall be limited to approved locations.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. Cooktops and ranges shall be provided with a domestic cooking hood installed and constructed in accordance with Section 505 of the *International Mechanical Code*.

420.11.2 Cooking appliances in sleeping rooms. Cooktops, ranges and ovens shall not be installed or used in sleeping rooms.

[W] 420.12 Adult family homes. This section shall apply to all newly constructed adult family homes and all existing single-family homes being converted to adult family homes. This section shall not apply to those adult family homes licensed by the state of Washington Department of Social and Health Services prior to July 1, 2001.

420.12.1 Sleeping room classification. Each sleeping room in an adult family home shall be classified as one of the following:

1. Type S – Where the means of egress contains stairs, elevators or platform lifts.
2. Type NS1 – Where one means of egress is at grade level or a ramp constructed in accordance with Section 1012 is provided.
3. Type NS2 – Where two means of egress are at grade level or ramps constructed in accordance with Section 1012 are provided.

420.12.2 Types of locking devices and door activation. All bedrooms and bathroom doors shall be openable from the outside when locked. Every closet door shall be readily openable from the inside. Operable parts of door handles, pulls, latches, locks and other devices installed in adult family homes shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Pocket doors shall have graspable hardware available when in the closed or open position.

The force required to activate operable parts shall be 5.0 pounds (22.2 N) maximum. Required exit door(s) shall have no additional locking devices. Required exit door hardware shall unlock inside and out-side mechanisms when exiting the building allowing reentry into the adult family home without the use of a key, tool or special knowledge.

420.12.3 Smoke and carbon monoxide alarm requirements. Alarms shall be installed in such a manner so that the detection device warning is audible from all areas of the dwelling upon activation of a single alarm.

420.12.4 Escape windows and doors. Every sleeping room shall be provided with emergency escape and rescue windows as required by Section 1031. No alternatives to the sill height such as steps, raised platforms or other devices placed by the openings will be approved as meeting this requirement.

420.12.5 Grab bar general requirements. Where facilities are designated for use by adult family home clients, grab bars for water closets, bathtubs and shower stalls shall be installed according to ICC A117.1.

420.12.6 Shower stalls. Where provided to meet the requirements for bathing facilities, the minimum size of shower stalls for an adult family home shall be 30 inches deep by 48 inches long.

[W] 420.13 Licensed care cooking facilities. In Group I-1, Condition 2 assisted living facilities licensed under chapter 388-78A WAC and residential treatment facilities licensed under chapter 246-337 WAC, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted to be open to the corridor where all of the following criteria are met:

1. The number of care recipients housed in the smoke compartment is not greater than 30.
2. The number of care recipients served by the cooking facility is not greater than 30.
3. Only one cooking facility area is permitted in a smoke compartment.
4. The types of domestic cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
5. The corridor is a clearly identified space delineated by construction or floor pattern, material or color.
6. The space containing the domestic cooking facility shall be arranged so as not to obstruct access to the required exit.
7. A domestic cooking hood installed and constructed in accordance with Section 505 of the International Mechanical Code is provided over the cooktop or range.
8. The domestic cooking hood provided over the cooktop or range shall be equipped with an automatic fire-extinguishing system of a type recognized for protection of domestic cooking equipment. Pre-engineered automatic extinguishing systems shall be tested in accordance with UL 300A and listed and labeled for the intended application. The system shall be installed in accordance with this code, its listing and the manufacturer's instructions.
9. A manual actuation device for the hood suppression system shall be installed in accordance with Sections 904.12.1 and 904.12.2.
10. An interlock device shall be provided such that upon activation of the hood suppression system, the power or fuel supply to the cooktop or range will be turned off.
11. A shut-off for the fuel and electrical power supply to the cooking equipment shall be provided in a location that is accessible only to staff.
12. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
13. A portable fire extinguisher shall be installed in accordance with Section 906 of the International Fire Code.

[W] 420.14 Lofts. Where provided in Group R occupancies, lofts shall comply with this code as modified by Sections 420.14.1 through 420.14.5. Lofts constructed in compliance with this section shall be considered a portion of the story below. Such lofts shall not contribute to either the building area or number of stories as regulated by Section 503.1. The loft floor area shall be included in determining the fire area.

Exception: Lofts need not comply with Section 420.14 where they meet any of the following conditions:

1. The loft has a maximum depth of less than 3 feet (914 mm).
2. The loft has a floor area of less than 35 square feet (3.3 m^2).
3. The loft is not provided with a permanent means of egress.

420.14.1 Loft limitations. Lofts shall comply with the following conditions:

1. The loft floor area shall be less than 70 square feet (6.5 m^2).
2. The loft ceiling height shall not exceed 7 feet (2134 mm) for more than one-half of the loft floor area.

The provisions of Sections 420.14.2 through 420.14.5 shall not apply to lofts that do not comply with Items 1 and 2.

420.14.2 Loft ceiling height. The ceiling height below a loft shall not be less than 7 feet (2134 mm). The ceiling height above the finished floor of the loft shall not be less than 3 feet (914 mm). Portions of the loft with a sloped ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not contribute to the loft floor area.

420.14.3 Loft area. The aggregate area of all lofts and mezzanines within a room shall comply with Section 505.2.1.

Exception: The area of a single loft shall not be greater than two-thirds of the area of the room in which it is located, provided that no other lofts or mezzanines are open to the room in which the loft is located.

420.14.4 Permanent egress for lofts. Where a permanent means of egress is provided for lofts, the means of egress shall comply with Chapter 10 as modified by Section 420.14.4.1.

420.14.4.1 Ceiling height at loft means of egress. A minimum ceiling height of 3 feet shall be provided for the entire width of the means of egress from the loft.

420.14.5 Smoke alarms. Single- or multiple-station smoke alarms shall be installed in all lofts in accordance with Section 907.2.11.1 or 907.2.11.2.

* **[S] 420.15 Security from criminal activity in Group R.**

420.15.1 Group R occupancies other than one- and two-family dwellings. All housing units except one- and two-family *dwellings* shall comply with Section 420.15.1.

420.15.1.1 Definition. For the purposes of this section, "housing unit" is any *dwelling unit* or guest room.

420.15.1.2 Building entrance doors and locks. Building entrance doors shall be without openings and shall be as capable of resisting forcible entry as a flush solid core wood door 1-3/8 inches (35 mm) thick.

Exceptions:

1. Building entrance doors are permitted to have visitor-observation ports that do not impair the fire resistance of the door.
2. Main entrance doors are permitted to be framed or unframed non-shattering glass, framed 1/4-inch (6 mm) plate glass or other security glazing.
3. Building entrance doors other than main entrance doors are permitted to have glazed openings. Glazed openings shall have wire, grilles or security glazing to prevent operation of the door latch from outside by hand or instrument.

Building entrance doors shall be self-closing, self-locking and equipped with a dead-locking latch bolt with at least a 1/2-inch (13 mm) throw that shall penetrate the striker at least 1/4 inch (6 mm).

Exceptions:

1. Building entrance doors that open directly into a housing unit shall comply with Section 420.15.1.4.
2. Garage-to-building doors need not be self-locking when the garage-to-exterior door is equipped with an electrically-operated remote control device for opening and automatically closing.
3. When either the garage-to-exterior doors or garage-to-building doors are equipped for self-closing and self-locking, the other need not be so equipped.

420.15.1.3 Locks. All *exit* doors, including those from individual housing units, shall be openable from the interior without use of keys or special knowledge or effort.

420.15.1.4 Housing unit doors and locks. Doors from interior *corridors* to individual housing units shall not have glass openings and shall be as capable of resisting forcible entry as a flush solid core wood door 1-3/8 (35 mm) inches thick.

Every entrance door to a housing unit shall have a dead bolt or dead-locking latch bolt with at least a 1/2-inch (13 mm) throw that penetrates the striker not less than 1/4 inch (6 mm). In hotels and other multi-unit buildings that provide housing for rent on a daily or weekly basis, every entrance door to a housing unit shall also be provided with a chain door guard or barrel bolt on the inside.

420.15.1.5 Observation ports. Every entrance door to a housing unit, other than transparent doors, shall have a visitor-observation port. The port shall not impair the fire resistance of the door. Observation ports shall be installed not less than 54 inches (1372 mm) and not more than 66 inches (1676 mm) above the floor.

420.15.1.6 Non-exit doors. Doors to storage, maintenance and building service rooms shall be self-closing and self-locking.

420.15.1.7 Sliding doors. Dead bolts or other *approved* locking devices shall be provided on all sliding doors. These locks shall be installed so that the mounting screws for the lock cases are inaccessible from the outside.

420.15.1.8 Windows. Openable windows shall have operable inside latching devices.

Exception: Windows with sills located 10 feet (3048 mm) or more above grade, or 10 feet (3048 mm) or more above a deck, balcony or porch that is not readily accessible from grade except through a housing unit need not have operable inside latching devices.

420.15.2 One- and two-family dwellings. One- and two-family *dwellings* shall comply with Section 420.15.2.

420.15.2.1 Building entrance locks. Building entrance doors, including garage doors, shall be capable of locking. They shall be equipped with a dead-locking latch bolt with at least a 1/2-inch (13 mm) throw that penetrates the striker not less than 1/4 inch (6 mm). Building entrance doors shall be openable from the inside without use of a key or special knowledge or effort.

Exception: Garage-to-exterior doors are permitted to be equipped with an electronically-operated remote control device for opening and closing in lieu of a dead-locking latch bolt. When garage-to-exterior doors are equipped with remote control devices, garage-to-building doors need not be capable of locking.

420.15.2.2 Observation ports. Every building entrance door, other than garage doors, shall have a visitor observation port or glass side light. Observation ports shall be installed at a height of not less than 54 inches (1372 mm) and not more than 66 inches (1676 mm) from the floor.

420.15.2.3 Windows and sliding doors. Dead bolts or other *approved* locking devices shall be provided on all sliding doors and openable windows. The lock shall be installed so that the mounting screws for the lock case are inaccessible from the outside.

Exception: Windows with sills located 10 feet (3048 mm) or more above grade, or 10 feet (3048 mm) or more above a deck, balcony or porch that is not readily accessible from grade except through a housing unit need not have operable inside latching devices.

420.15.3 Alternate security devices. Subject to the approval of the *building official*, alternate security devices are permitted to be substituted for those required by this Section 420.15. Alternate devices shall have equal capability to resist illegal entry. The installation of the device shall not conflict with other requirements of this code and other ordinances regulating the safety of exiting.

[S] 420.16 Roof-ceiling soffits. Roof-ceiling soffits in *dwelling units* and sleeping units shall be provided with a minimum of 1/2-inch (13 mm) gypsum wallboard in buildings of Types IIB, IIIB and VB construction. **

SECTION 421
HYDROGEN FUEL GAS ROOMS

[F] 421.1 General. Where required by the *International Fire Code*, *hydrogen fuel gas rooms* shall be designed and constructed in accordance with Sections 421.1 through 421.7.

[F] 421.2 Location. *Hydrogen fuel gas rooms* shall not be located below grade.

[F] 421.3 Design and construction. *Hydrogen fuel gas rooms* not classified as Group H shall be separated from other areas of the building in accordance with Section 509.1.

[F] 421.3.1 Pressure control. *Hydrogen fuel gas rooms* shall be provided with a ventilation system designed to maintain the room at a negative pressure in relation to surrounding rooms and spaces.

[F] 421.3.2 Windows. Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted where in accordance with Section 716.

[F] 421.4 Exhaust ventilation. *Hydrogen fuel gas rooms* shall be provided with mechanical exhaust *ventilation* in accordance with the applicable provisions of Section 502.16.1 of the *International Mechanical Code*.

[F] 421.5 Gas detection system. *Hydrogen fuel gas rooms* shall be provided with a *gas detection system* that complies with Sections 421.5.1, 421.5.2, and 916.

[F] 421.5.1 System activation. Activation of a gas detection alarm shall result in both of the following:

1. Initiation of distinct audible and visible alarm signals both inside and outside of the *hydrogen fuel gas room*.
2. *Automatic* activation of the mechanical exhaust ventilation system.

[F] 421.5.2 Failure of the gas detection system. Failure of the *gas detection system* shall automatically activate the mechanical exhaust *ventilation* system, stop hydrogen generation, and cause a trouble signal to sound at an *approved* location.

[F] 421.6 Explosion control. *Explosion* control shall be provided where required by Section 414.5.1.

[S][F] 421.7 ((~~Standby~~)) Legally required standby power. Mechanical *ventilation* and *gas detection systems* shall be provided with a *standby power system* in accordance with Section 2702.

SECTION 422
AMBULATORY CARE ((~~FACILITIES~~)) FACILITIES

422.1 General. Occupancies classified as *ambulatory care facilities* shall comply with the provisions of Sections 422.1 through 422.7 and other applicable provisions of this code.

422.2 Separation. *Ambulatory care facilities* where the potential for four or more care recipients are to be *incapable of self-preservation* at any time shall be separated from adjacent spaces, *corridors* or tenants with a *fire partition* installed in accordance with Section 708.

422.3 Smoke compartments. Where the aggregate area of one or more *ambulatory care facilities* is greater than 10,000 square feet (929 m^2) on one *story*, the *story* shall be provided with a *smoke barrier* to subdivide the *story* into not fewer than two *smoke compartments*. The area of any one such *smoke compartment* shall be not greater than 22,500 square feet (2092 m^2). The distance of travel from any point in a *smoke compartment* to a *smoke barrier* door shall be not greater than 200 feet (60 960 mm). The *smoke barrier* shall be installed in accordance with Section 709 with the exception that *smoke barriers* shall

be continuous from outside wall to an outside wall, a floor to a floor, or from a *smoke barrier* to a *smoke barrier* or a combination thereof.

[W] 422.3.1 Means of egress. Where *ambulatory care facilities* require smoke compartmentation in accordance with Section 422.3, the fire safety evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support ((~~a *defend-in-place* emergency response in accordance with~~)) Sections 403 and 404 of the *International Fire Code*.

422.3.2 Refuge area. Not less than 30 net square feet (2.8 m^2) for each nonambulatory care recipient shall be provided within the aggregate area of *corridors*, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each *smoke compartment*. Each occupant of an *ambulatory care facility* shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

422.3.3 Independent egress. A *means of egress* shall be provided from each *smoke compartment* created by *smoke barriers* without having to return through the *smoke compartment* from which *means of egress* originated.

[F] 422.4 Automatic sprinkler systems. *Automatic sprinkler systems* shall be provided for *ambulatory care facilities* in accordance with Section 903.2.2.

[F] 422.5 Fire alarm systems. A *fire alarm* system shall be provided for *ambulatory care facilities* in accordance with Section 907.2.2.

[F] 422.6 Electrical systems. In *ambulatory care facilities*, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.

422.7 Domestic cooking. Installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the International Mechanical Code shall be provided over cooktops or ranges.
3. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
4. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
5. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

SECTION 423
STORM SHELTERS

423.1 General. This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as rooms or spaces within buildings for the purpose of providing protection from storms that produce high winds, such as tornadoes and hurricanes, during the storm. This section specifies where *storm shelters* are required and provides requirements for the design and construction of *storm shelters*. Design of facilities for use as emergency shelters after the storm are outside the scope of ICC 500 and shall comply with Table 1604.5 as a *Risk Category* IV Structure.

423.2 Construction. *Storm shelters* shall be constructed in accordance with this code and ICC 500 and shall be designated as hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Buildings or structures that are also designated as emergency shelters shall also comply with Table 1604.5 as *Risk Category* IV structures.

Any *storm shelter* not required by this section shall be permitted to be constructed, provided that such structures meet the requirements of this code and ICC 500.

423.3 Occupancy classification. The occupancy classification for a *storm shelter* shall be determined in accordance with this section.

423.3.1 Dedicated storm shelters. A facility designed to be occupied solely as a *storm shelter* shall be classified as Group A-3 for the determination of requirements other than those covered in ICC 500.

Exceptions:

1. The occupancy category for dedicated storm shelters with an occupant load of fewer than 50 persons as determined in accordance with ICC 500 shall be in accordance with Section 303.
2. The occupancy category for a dedicated residential storm shelter shall be the Group R occupancy served.

[F] 426.1.3 Conveyors. Conveyors, chutes, piping and similar equipment passing through the enclosures of rooms or spaces shall be constructed dirt tight and vapor tight, and be of *approved* noncombustible materials complying with Chapter 30.

[F] 426.1.4 Explosion control. *Explosion* control shall be provided as specified in the *International Fire Code*, or spaces shall be equipped with the equivalent mechanical *ventilation* complying with the *International Mechanical Code*.

[F] 426.1.5 Grain elevators. Grain elevators, malt houses and buildings for similar occupancies shall not be located within 30 feet (9144 mm) of interior *lot lines* or structures on the same *lot*, except where erected along a railroad right-of-way.

[F] 426.1.6 Coal pockets. Coal pockets located less than 30 feet (9144 mm) from interior *lot lines* or from structures on the same *lot* shall be constructed of not less than Type IB construction. Where more than 30 feet (9144 mm) from interior *lot lines*, or where erected along a railroad right-of-way, the minimum type of construction of such structures not more than 65 feet (19 812 mm) in *building height* shall be Type IV.

[F] 426.1.7 Tire rebuilding. Buffing operations shall be located in a room separated from the remainder of the building housing the tire rebuilding or tire recapping operation by a 1-hour *fire barrier*.

Exception: Buffing operations are not required to be separated where all of the following conditions are met:

1. Buffing operations are equipped with an *approved* continuous automatic water-spray system directed at the point of cutting action.
2. Buffing machines are connected to particle-collecting systems providing a minimum air movement of 1,500 cubic feet per minute (cfm) (0.71 m^3/s) in volume and 4,500 feet per minute (fpm) (23 m/s) in-line velocity.
3. The collecting system shall discharge the rubber particles to an *approved* outdoor noncombustible or fire-resistant container, which is emptied at frequent intervals to prevent overflow.

SECTION 427
MEDICAL GAS SYSTEMS

[S][F] 427.1 General. Medical gases at health care-related facilities intended for patient ((~~or veterinary~~)) care, inhalation or sedation, including but not limited to analgesia systems for dentistry, podiatry, veterinary and similar uses, shall comply with Sections 427.2 through 427.2.3 in addition to other requirements of this code and Chapter 53 of the *International Fire Code*.

[S][F] 427.2 Interior supply location. Medical gases shall be ((~~located~~)) stored in areas dedicated to the storage of such gases without other storage or uses. Where containers of medical gases in quantities greater than the permitted amount are located inside the buildings, they shall be located in a 1-hour exterior room, 1-hour interior room or a *gas cabinet* in accordance with Section 427.2.1, 427.2.2 or 427.2.3, respectively. Rooms or areas where medical gases are stored or used in quantities exceeding the maximum allowable quantity per control area as set forth in ((~~TABLE 307.1(1) and [F] TABLE 307.1(2)~~)) *International Fire Code* Section 5003.1 shall ((~~be in accordance~~)) comply with the requirements for Group H occupancies.

[F] 427.2.1 One-hour exterior room. A 1-hour exterior room shall be a room or enclosure separated from the remainder of the building by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, with a *fire-resistance rating* of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be provided with *self-closing* smoke- and draft-control assemblies having a *fire protection rating* of not less than 1 hour. Rooms shall have not less than one *exterior wall* that is provided with not less than two vents. Each vent shall have a minimum free ((~~air~~)) opening area of ((~~not less than 36~~)) 24 square inches (((~~232~~)) 155 cm^2) for each 1,000 cubic feet (28 m^3) at normal temperature and pressure (NTP) of gas stored in the room and shall be not less than 72 square inches (465 cm^2) in aggregate free opening area. One vent shall be within 6 inches (152 mm) of the floor and one shall be within 6 inches (152 mm) of the ceiling. Rooms shall be provided with not fewer than one automatic fire sprinkler to provide container cooling in case of fire.

[F] 427.2.2 One-hour interior room. Where an *exterior wall* cannot be provided for the room, ((~~a 1-hour interior room shall be provided and shall be a room or enclosure separated from the remainder of the building by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, with a *fire-resistance rating* of not less than 1 hour. Openings~~)) openings between the room or enclosure and interior spaces shall be provided with *self-closing* ((~~smoke- and draft-control~~)) assemblies. ((~~having a *fire protection rating* of not less than 1 hour. An *automatic*~~)) *Automatic sprinklers* ((~~*system*~~)) shall be installed within the room. The room shall be exhausted through a duct to the exterior. Supply and exhaust ducts shall be enclosed in a 1-hour rated ((~~*shaft*~~)) *enclosure* from the room to the exterior. Approved mechanical *ventilation* shall comply with the *International Mechanical Code* and be provided with a minimum rate of 1 cubic foot per minute per square foot (0.00508 $m^3/s/m^2$) of the area of the room.

Exception: A 1-hour rated enclosure to the exterior is not required where the building is equipped with an automatic sprinkler system throughout.

[F] 427.2.3 Gas cabinets. Gas cabinets shall be constructed in accordance with Section 5003.8.6 of the *International Fire Code* and shall comply with the following:

((~~1. Cabinets shall be exhausted to the exterior through a dedicated exhaust duct system installed in accordance with Chapter 5 of the *International Mechanical Code*.~~

~~2~~)) 1. ((~~Supply and exhaust ducts shall be enclosed in a 1-hour rated *shaft enclosure* from the cabinet to the exterior.~~)) The average velocity of *ventilation* at the face of access ports or windows shall be not less than 200 feet per minute (1.02 m/s) with a minimum of 150 feet per minute (0.76 m/s) at any point of the access port or window.

2. They shall be connected to an exhaust system.

3. Cabinets shall be provided with an *automatic sprinkler system* internal to the cabinet.

[S] 427.3 Exterior supply locations. Oxidizer medical gas systems located on the exterior of a building with quantities greater than the permit amount shall be located in accordance with *International Fire Code* Section 6304.2.1.

SECTION 428
HIGHER EDUCATION LABORATORIES

[F] 428.1 Scope. *Higher education laboratories* complying with the requirements of Sections 428.1 through 428.4 shall be permitted to exceed the maximum allowable quantities of *hazardous materials* in *control areas* set forth in Tables 307.1(1) and [F] 307.1(2) without requiring classification as a Group H occupancy. Except as specified in Section 428, such laboratories shall comply with all applicable provisions of this code and the *International Fire Code*.

[F] 428.2 Application. The provisions of Section 428 shall be applied as exceptions or additions to applicable requirements of this code. Unless specifically modified by Section 428, the storage, *use* and handling of *hazardous materials* shall comply with all other provisions in Chapters 38 and 50 through 67 of the *International Fire Code* and this code for quantities not exceeding the maximum allowable quantity.

[F] 428.3 Laboratory suite construction. Where *laboratory suites* are provided, they shall be constructed in accordance with this section and Chapter 38 of the *International Fire Code*. The number of *laboratory suites* and percentage of maximum allowable quantities of *hazardous materials* in *laboratory suites* shall be in accordance with Table 428.3.

[F] TABLE 428.3
DESIGN AND NUMBER OF LABORATORY SUITES PER FLOOR

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER LAB SUITE[a]	NUMBER OF LAB SUITES PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[b]
Above Grade Plane	21+	Not allowed	Not Permitted	Not Permitted
	16-20	25	1	2[c]
	11-15	50	1	2[c]
	7-10	50	2	2[c]
	4-6	75	4	1
	3	100	4	1
	1-2	100	6	1
Below Grade Plane	1	75	4	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the footnotes to those tables.
b. Fire barriers shall include walls, floors and ceilings necessary to provide separation from other portions of the building.
c. Vertical fire barriers separating laboratory suites from other spaces on the same floor shall be permitted to be 1-hour fire-resistance rated.

[F] 428.3.1 Separation from other nonlaboratory areas. *Laboratory suites* shall be separated from other portions of the building in accordance with the most restrictive of the following:

1. *Fire barriers* and *horizontal assemblies* as required in Table 428.3. *Fire barriers* shall be constructed in accordance with Section 707 and *horizontal assemblies* constructed in accordance with Section 711.

   Exception: Where an individual *laboratory suite* occupies more than one *story*, the *fire-resistance rating* of intermediate floors contained within the *laboratory suite* shall comply with the requirements of this code.

2. Separations as required by Section 508.

[F] 428.3.2 Separation from other laboratory suites. *Laboratory suites* shall be separated from other *laboratory suites* in accordance with Table 428.3.

[F] 428.3.3 Floor assembly fire resistance. The floor assembly supporting *laboratory suites* and the construction supporting the floor of *laboratory suites* shall have a *fire-resistance rating* of not less than 2 hours.

Exception: The floor assembly of the *laboratory suites* and the construction supporting the floor of the *laboratory suites* are allowed to be 1-hour *fire-resistance* rated in buildings of Types IIA, IIIA and VA construction, provided that the building is three or fewer *stories.*

[F] 428.3.4 Maximum number. The maximum number of *laboratory suites* shall be in accordance with Table 428.3. Where a building contains both *laboratory suites* and *control areas,* the total number of *laboratory suites* and *control areas* within a building shall not exceed the maximum number o*f laboratory suites* in accordance with Table 428.3.

[F] 428.3.5 Means of egress. *Means of egress* shall be in accordance with Chapter 10.

[F] 428.3.6 Standby or emergency power. Standby or emergency power shall be provided in accordance with Section 414.5.2 where *laboratory suites* are located above the sixth *story above grade plane* or located in a *story* below *grade plane*.

[F] 428.3.7 Ventilation. *Ventilation* shall be in accordance with Chapter 7 of NFPA 45, and the *International Mechanical Code*.

[F] 428.3.8 Liquid-tight floor. Portions of *laboratory suites* where *hazardous materials* are present shall be provided with a liquid-tight floor.

[F] 428.3.9 Automatic sprinkler systems. Buildings containing *laboratory suites* shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 428.4 Percentage of maximum allowable quantity in each laboratory suite. The percentage of maximum allowable quantities of *hazardous materials* in each *laboratory suite* shall be in accordance with Table 428.3.

[S] SECTION 429
WATERFRONT STRUCTURES: PIERS, WHARVES AND BUILDINGS

429.1 Scope. Structures with at least 20 percent or 8,000 square feet (743 m^2), whichever is greater, of their area over water shall comply with Section 429. They shall also comply with all other requirements of this code unless otherwise specified in Section 429. Unless otherwise specified, all wood dimensions are nominal size as defined in Section 202.

Exceptions:

1. Fire-resistance-rated walls specified in Section 429.6.6 are permitted to be used as one-hour fire-resistance-rated fire barriers and as a separation between *repair garages* not classified as Group S-1 and occupancies in Group A, including the specified opening protection in buildings of Types IIB, IV and VB construction.
2. Structures accessory to Group R-3 occupancies.
3. Floating homes that comply with the Seattle Residential Code.

See Chapter 36 of the Fire Code for additional requirements for fire protection systems for *marinas*.

429.2 Allowable area and height for waterfront structures. The height of structures to be built over water shall be measured as provided in Title 23 of the Seattle Municipal Code for Shoreline Districts. Height and area shall comply with the requirements of Chapter 5, except that the increases allowed in Section 507 are not applicable to waterfront structures.

Exceptions:

1. In *covered boat moorages*, the areas in Table 506.2 are permitted to be increased not more than 400 percent when an *approved automatic sprinkler system* is provided throughout.
2. Each covered area of a boat moorage is permitted to be considered a separate building subject to the following conditions:
   - 2.1. Maximum individual areas shall be 8,000 square feet (743 m^2). The maximum width of connecting walkways shall be 10 feet (3048 mm).
   - 2.2. Walkways, finger *piers* and other decked areas shall not exceed 30 percent of the area of the roof that extends over water.
   - 2.3. Covered areas shall be separated by not less than 16 feet (4877 mm). The intervening areas are permitted to be used for moorage provided the adjacent covered areas comply with Item 2.4 below.
   - 2.4. Covered roof areas constructed in a manner that would trap smoke or hot gases shall be provided with the following:
     - 2.4.1. Vents or monitors of not less than 5 percent of the roof area.

2.4.2. A draft stop of splined or tongue-and-groove planking not less than 1 inch (25 mm) in thickness, 1/2-inch (13 mm) exterior-type plywood or 26 gauge steel shall extend across the end of each roof area when the roof is closer than 30 feet (9144 mm) to an adjacent building. The draft stop shall extend to not less than 24 inches (610 mm) below the lower edge of the roof. A draft stop constructed in accordance with Section 429.5.2 shall be provided under the walkway at each location where draft stops are required at the end of roofed areas.

429.3 Accessory uses. Uses accessory to the principal occupancy shall be permitted, provided they are conducted in an area separated from the moorage area by not less than 16 feet (4877 mm) and the exposed side of the moorage area is protected by a one-hour fire-resistance-rated fire barrier extending 2-1/2 feet (762 mm) above the roof line. One-*story superstructures* shall be permitted for accessory uses but shall not exceed 1,000 square feet (93 m^2) in area nor 20 feet (6096 mm) in height.

Exception: Storage is allowed in the moorage area, provided it conforms to the following:

1. One unprotected moorage equipment locker of not more than 150 cubic feet (115 m^3) is permitted for each *slip*.
2. Where groups of three or more lockers are provided, they shall be separated from each other with one-hour fire-resistance-rated fire partitions, and openings in the separation shall have one-hour protection.
3. Storage of flammable liquids shall be in accordance with NFPA 31 and the Fire Code.

429.4 Location on property. Exterior walls shall have fire resistance and opening protection as determined by Section 705.

Exceptions:

1. Fire resistance-rated construction and opening protection required because of proximity to property lines are permitted to be omitted for waterfront structures that are located on the same property, separated by an unobstructed deck not less than 16 feet (4877 mm) wide, and have a draft stop constructed according to Section 429.4.2 installed in the *substructure* between the buildings.
2. In *covered boat moorages*, exterior walls that are built entirely over water are permitted to be of tongue-and-groove or splined planks not less than 2 inches (51 mm) in thickness, covered with 26 gauge sheet metal, 3/8-inch (9.5 mm) exterior type plywood or equivalent on both sides, regardless of proximity to property lines. Walls at the *substructure* are permitted to be constructed as specified in Section 429.5.2 for draft stops. Where such walls (even though part of such *covered boat moorage*) are built on land, this exception shall not apply.

429.5 Substructure.

429.5.1 Construction. *Substructures* are permitted to be of any type of construction permitted in this code subject to the area limitations of Section 429.2, except that, when constructed of wood, the members shall not be less than the following in any dimension, exclusive of piling:

MEMBER	SIZE UNLIMITED USE × 25.4 FOR MM	PIERS FOR BOAT MOORAGE ONLY, NOT EXCEEDING 10 FEET (3048 MM) IN WIDTH × 25.4 FOR MM
Caps and girders	8"	6"
Joists, beams and other members	4"	3"
Flooring or deck	3" T & G or splined or 4" square edged	2"
Bracing	3"	2"

For SI: 1 inch = 25.4 mm

429.5.1.1 Flooring for covered piers. If the flooring or deck is under a roof or is used for parking, there shall be applied over the flooring or deck a tight-fitting wearing surface of softwood not less than 2 inches (51 mm) thick and not more than 6 inches (152 mm) wide, 1-inch (25 mm) thick hardwood, 2-inch (51 mm) thick asphaltic concrete or other material of equivalent fire resistance.

Exception: Covered *piers* used for moorage only need not have a wearing surface.

429.5.2 Draft stops. Draft stops shall be installed in all *substructures* constructed of combustible materials, exclusive of piling and pile bracing. They shall be placed not more than 100 feet (2540 mm) apart measured along the main axis of the *pier* or *wharf*. They shall fit tightly around all joists, beams, etc., and extend from the underside of the deck to city datum if over salt water or to low water if over fresh water. See Section 429.6.7 for draft stops in *superstructures*.

Substructure draft stops shall be constructed of at least two layers of lumber not less than 2 inches (51 mm) in thickness laid with broken joints or materials of equal fire resistance.

429.6 Superstructure.

429.6.1 Construction. *Superstructures* are permitted to be of any type of construction permitted by this code subject to the height and area limitations of Section 429.2 and the requirements of this section.

429.6.2 Floors. See Section 429.6.

429.6.3 Exterior walls. Exterior walls of Types IIA, IIB, III, IV and V buildings, when not subject to the requirements of Section 429.5 because of their proximity to property lines, are permitted to be constructed of matched or lapped lumber not less than 2 inches (51 mm) thick and not more than 6 inches (153 mm) wide, or not less than 1 inch (25 mm) thick with a weather covering of noncombustible material applied directly to the wood. Fireblocking is an assembly having a three-fourths-hour fire- protection rating when fire-resistive openings are required by Sections 705 and 1028.

429.6.4 Roof coverings. Roof coverings shall be fire-retardant as specified in Chapter 15.

429.6.5 Roof construction. In Type IV buildings the roof is permitted to be constructed of corrugated galvanized steel attached directly to wood or steel purlins in lieu of that specified in Section 602.4.

429.6.6 Fire-resistance-rated walls. In Types IIA, IIB, III, IV and V buildings, there shall be at least one fire-resistance-rated wall from the deck to at least 3 feet (914 mm) above the roof for each 500 feet (152 m) of length. Areas greater than l00,000 square feet (9290 m^2) shall be divided with such fire-resistance-rated walls. There shall be a draft stop constructed as specified in Section 429.6.2, installed in the *substructure* immediately below every required fire-resistance-rated wall when the deck is of combustible materials.

Fire-resistance-rated walls shall be constructed as required for two-hour fire-resistance-rated walls or are permitted to consist of at least two layers of tongue-and-groove or splined lumber, not less than 2 inches (51 mm) thick and not more than 6 inches (153 mm) wide, with a sheet of not less than No. 26 gauge galvanized steel or 3/8-inch (3.2 mm) exterior type plywood between the two layers, placed vertically with broken joints, or equivalent fire-resistive construction.

Openings in fire-resistance-rated walls shall be protected by opening protectives having a one and one-half hour fire protection rating.

429.6.7 Draft stops. *Superstructure* draft stops shall be installed as specified in Section 718. *Substructure* draft stops constructed as specified in Section 429.5.2 shall be installed in line with the *superstructure* draft stops above. See Section 429.11 for draft curtain requirements.

429.6.8 Means of egress. Means of egress shall be provided as specified in Chapter 10.

Exceptions:

1. Where two means of egress are required from an occupancy, they shall not terminate on the same open deck.
2. An open deck is permitted to be considered an exit court and shall not be less than 10 feet (3048 mm) in width.
3. In Group A occupancies, the maximum travel distance shall not be more than 75 percent of that specified in Section 1017.
4. Boat moorages that have no sales, service or repair facilities are permitted to have a single means of egress not less than 3 feet (914 mm) wide and shall be exempt from the requirements of Section 1017 if a Class I standpipe is provided as specified in Section 429.8.

429.7 Width of piers. Floats, *piers* and walkways shall provide an *aisle* not less than 3 feet 6 inches (1067 mm) in width for the purpose of fire department access.

Exception: Floats, *piers* and walkways that are less than 40 feet (12192 mm) in length and that are not open to the public.

429.8 Standpipe systems. A manual Class I standpipe system (or Class III standpipe system when *approved* by the *fire code official*) in accordance with NFPA Standard 14 shall be provided for *piers*, wharves, and floats where the hose lay distance from the fire apparatus to the most remote accessible portion of the *pier*, *wharf* or float exceeds 150 feet (45720 mm). *Approved* plastic pipe may be used when installed underwater, or other *approved* method of protection from fire is provided. The standpipe piping shall be a minimum of 4 inches (102 mm), sized to provide a minimum of 500 gpm at 130 psi at the most remote hose connection, with a simultaneous flow of 500 gpm at the third most remote hose connection on the same *pier* while maintaining a maximum system pressure of 175 psi. Existing standpipe systems providing equivalent performance to the specification listed above may be acceptable when *approved* by the *fire code official*.

429.8.1 Hose connections. Hose connection stations on required standpipes shall be provided at the water end of the *pier*, *wharf*, or float, and along the entire length of the *pier*, *wharf*, or float at spacing not to exceed 150 feet (45720 mm) and as close as practical to the land end.

Exception: The hose connection at the land end of the *pier*, *wharf* or float may be omitted when a hose connection is located within 150 feet (45,720 mm) of the fire apparatus access road.

Each hose connection shall consist of a valved 2-1/2-inch (64 mm) fire department hose outlet. Outlet caps shall have a predrilled 1/8-inch (3.2 mm) hole for pressure relief and be secured with a short length of chain or cable to prevent falling after removal. Listed equipment shall be used.

429.8.2 Hose stations. Hose stations on required standpipes shall be provided at spacing not to exceed 100 feet, with the first hose station located as close as practicable to the land end of the *pier*. Each hose station shall have 100 feet of 1-1/2-inch hose mounted on a reel or rack and enclosed within an *approved* cabinet. A valved 2-1/2-inch fire department hose outlet shall be provided at each hose station. Outlet caps shall have a 1/8-inch predrilled hole for pressure relief and be

secured with a short length of chain or cable to prevent falling after removal. Listed equipment shall be used. Hose stations shall be labeled FIRE HOSE-EMERGENCY USE ONLY.

429.8.3 Freeze protection. Standpipe systems shall be maintained dry when subject to freezing temperatures, and always from November 1 through March 31. The 1-1/2-inch hose stations shall be tagged out of service when the system is drained. The main water supply control valve shall be readily accessible and clearly labeled so that the system may be quickly restored to full service during periods when the system is drained down.

Exception: Other methods of freeze protection, such as listed freeze valves, are permitted to be provided when *approved* by the *fire code official*.

429.9 Automatic sprinklers.

429.9.1 Covered boat moorage. Automatic sprinklers shall be provided for *covered boat moorage* exceeding 500 square feet in projected roof area per *pier*, *wharf* or float.

The sprinkler system shall be designed and installed in accordance with NFPA 13 for Extra Hazard Group 2 occupancy.

If sprinklers are required by this section, they shall be extended to any structure on the *pier*, *wharf* or float exceeding 500 square feet in projected roof area.

429.9.2 Substructure. Automatic sprinklers shall be installed under the *substructure* of every new waterfront structure in accordance with NFPA 307 and as specified in Chapter 9.

Exception: Sprinklers are not required in the following locations:

1. Combustible *substructures* whose deck area does not exceed 8,000 square feet (743.2 m^2) supporting no *superstructures*.
2. Combustible *substructures* whose deck area does not exceed 8,000 square feet (743.2 m^2) supporting *superstructures* not required to be provided with an *approved automatic sprinkler system* as specified in Section 429.9.3.
3. Noncombustible *substructures* with or without *superstructures*.
4. *Substructures*, over other than tidal water, where sprinkler heads cannot be installed with a minimum clearance of 4 feet (1219 mm) above mean high water.
5. *Substructures* resulting from walkways or finger *piers* that do not exceed l0 feet (3048 mm) in width.

429.9.3 Superstructure. Automatic sprinklers shall be provided in *superstructures* as required by Chapter 9.

429.9.4 Monitoring. Sprinkler systems shall be monitored by an *approved* central station service.

429.10 Smoke and heat vents. *Approved* automatic smoke and heat vents shall be provided in *covered boat moorage* areas exceeding 2,500 square feet (232 m^2) in area, excluding roof overhangs.

Exception: Smoke and heat vents are not required in areas protected by automatic sprinklers.

429.10.1 Design and installation. Where smoke and heat vents are required they shall be installed near the roof peak, evenly distributed and arranged so that at least one vent is over each covered berth. The effective vent area shall be calculated using a ratio of one square foot of vent to every 15 square feet of covered berth area (1:15). Each vent shall provide a minimum opening size of 4 feet by 4 feet.

429.10.2 Automatic operation. Smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (56°C) and 220°F (122°C) above ambient.

Exception: Gravity-operated drop out vents.

429.10.3 Gravity-operated drop out vents. Gravity operated dropout vents shall fully open within five minutes after the vent cavity is exposed to a simulated fire represented by a time-temperature gradient that reaches an air temperature of 500°F (260°C) within five minutes.

429.11 Draft curtains. Draft curtains shall be provided in *covered boat moorage* areas exceeding 2,500 square feet (232 m^2) in area, excluding roof overhangs.

Exception: Draft curtains are not required in areas protected by automatic sprinklers.

429.11.1 Draft curtain construction. Draft curtains shall be constructed of sheet metal, gypsum board or other *approved* materials that provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.

429.11.2 Draft curtain location and depth. The maximum area protected by draft curtains shall not exceed 2,000 square feet (186 m^2) or two *slips* or berths, whichever is smaller. Draft curtains shall not extend past the piling line. Draft curtains shall have a minimum depth of 2 feet (609 mm) below the lower edge of the roof and shall not extend closer than 8 feet (2438 mm) to the walking surface on the *pier*.

429.12 Fire department connections. Standpipe and sprinkler systems shall be equipped with not less than a two-way 2-1/2-inch fire department connection, which shall be readily visible and located at the fire department apparatus access. The fire

department connection for Class I standpipe systems may be located at the shore end of the *pier*, *wharf*, or float if the distance between the fire apparatus access road and fire department connection is less than 150 feet (45 720 mm). See Section 507 of the *International Fire Code* for requirements for fire hydrants.

429.13 Marina fire protection confidence testing. Standpipe and sprinkler systems shall be inspected and tested in compliance with the *International Fire Code*.

429.14 Fire department access. Fire department apparatus access lanes, not less than 20 feet wide and capable of supporting a 50,000-pound vehicle or 24,000 pounds per axle (HS20 loading), shall be provided and so located as to provide fire department apparatus access to within 50 feet travel distance to the shore end of all *piers*, wharves and floats.

[S] SECTION 430
PRIVATE AND UTILITY TRANSFORMER VAULTS

Note: Seattle City Light may have additional standards that supersede the requirements in this section.

430.1 Scope. Vaults housing private and utility transformers shall comply with the provisions of this chapter and Article 450 of the *Seattle Electrical Code*. The provisions of this chapter are minimum standards for all transformer vaults. Vaults containing utility transformers or equipment are required to comply with additional requirements of Seattle City Light.

430.2 When required.

430.2.1. Utility transformers. Transformer vaults are required for all utility transformers located inside a building. Seattle City Light shall approve the size, location, and layout of all utility vaults.

Exception: Vaults are not required for certain dry-type transformers rated 600 volts or less.

430.2.2 Private transformers. Transformer vaults are required for all oil-insulated private transformers. Vaults are required for other private transformers rated over 35,000 volts that are located inside a building.

Exception: Vaults are not required for certain oil-insulated private transformers in accordance with Sections 450.26 and 450.27 of the Seattle Electrical Code.

Note: Article 450, Part II of the Seattle Electrical Code contains requirements for transformers not required to be in a vault.

430.3 Access to transformer vaults.

430.3.1 General access. At least one door or hatch shall be provided in every vault. The opening shall be adequate in size to permit the installation and removal of the equipment located in the vault, and shall be kept unobstructed at all times. An unobstructed level area shall be provided at the entrance to all vaults. The level area shall be large enough to allow for movement of the transformer and equipment into and out of the vault.

430.3.2 Utility transformer vault access. *Utility transformer vaults* shall be accessible to Seattle City Light personnel at all times. If it is necessary to pass through locked doors to reach a vault, keys to those doors shall be kept in a key box that can be opened with the key to the transformer vault. The key box shall be mounted near the first door requiring a non-transformer door key. Persons other than Seattle City Light personnel shall not have access to *utility transformer vaults* without Seattle City Light personnel present.

All doors between the vault and the building exterior shall be large enough to accommodate the placement or removal of transformers. See Section 430.6 for doorway requirements.

Utility transformer vaults shall be located so that there is an equipment access path between the vault and the building exterior. The path shall comply with the following.

1. Sufficient horizontal and vertical clearance for the required transformer shall be provided;
2. The floor shall be smooth, without seams or ridges to impede transportation of heavy equipment;
3. There shall not be excessive slope as determined by Seattle City Light; and
4. The floor shall be designed to support the weight of the transformer and all equipment needed to move the transformer.

If Seattle City Light determines that it is infeasible to design a path in the prescribed manner, the building owner shall enter into a Transportation Agreement with Seattle City Light. The Transportation Agreement obligates the building owner to transport equipment between the right of way and the transformer vault whenever the Superintendent of Seattle City Light determines it is necessary, and to pay all costs for equipment transportation.

Note: The Transportation Agreement is a measure of last-resort and permitted only with prior Seattle City Light approval. A viable path for equipment transportation between the right-of-way and the transformer vault should be a primary design consideration.

430.4 Location of transformer vaults. Transformer vaults shall be located where they can be ventilated to the outside air without using flues or ducts wherever such an arrangement is practicable. Transformer vaults shall be dry and not subject to running, standing or infiltration of water.

Transformer vaults shall not be located where they are subject to flooding due to ground water without specific written approval by Seattle City Light.

430.5 Construction.

430.5.1 Private transformer vaults. *Private transformer vaults* shall comply with the following minimum requirements.

1. All *private transformer vaults* shall be of at least three-hour fire-resistive construction.

   Exception: Subject to the approval of the *building official*, where the total capacity of private oil-insulated transformers does not exceed 112-1/2 kVA, the vault is permitted to be constructed of reinforced concrete not less than 4 inches (102 mm) thick.
2. Vault floors in contact with the earth shall be of concrete not less than 4 inches thick.
3. The transformer shall be anchored to inserts embedded in the concrete floor.
4. In pre-tensioned or post-tensioned concrete, cable locations shall be permanently marked on the surface of the concrete over the encased tendons.
5. Vault dimensions shall be adequate for required ventilation and working clearances.

430.5.2 Utility transformer vaults. *Utility transformer vaults* shall comply with the following minimum requirements. The Superintendent of Seattle City Light is authorized to adjust the requirements of this Section 430.5.2 when deemed necessary.

1. Floors, walls and ceilings of *utility transformer vaults* shall have at least a three-hour fire-resistance rating and shall be constructed of solid concrete or concrete-filled concrete masonry units at least 6 inches (152 mm) thick.
2. Vault floors shall be smooth with no pads.
3. Seismic anchor inserts shall be embedded in the floor and steel support channels shall be embedded in the ceiling when required by the Superintendent of Seattle City Light.
4. Pre-tensioned or post-tensioned concrete shall have the cable locations permanently marked on the surface of the concrete over the encased tendons.
5. Vault dimensions shall depend upon physical size and number of secondary connection devices, working clearances, and shall be *approved* by the Superintendent of Seattle City Light.

430.6 Openings into transformer vaults. Transformer vault openings shall comply with this section and Sections 705.8.2 and 705.8.3.

430.6.1 Protection of openings. All doorways opening into a transformer vault from the building interior shall be protected by opening protectives having a fire-protection rating equal to that required for the vault.

430.6.2 Doorways. All doors shall be made of three-hour fire-resistance-rated steel and shall swing out of the vault 180 degrees. Doors that may be prevented from swinging 180 degrees outward as a result of blockage by vehicles or mobile equipment shall be protected by bollards. The bollards shall preserve the door swing area and shall not obstruct the doorway. Equipment access doorways shall be sized to accommodate the transformer placement and removal including the equipment necessary to place or remove the transformer.

Equipment access doorways to vaults containing only single-phase utility transformers shall have clear openings no less than 42 inches (1067 mm) wide and 6 feet 8 inches (2057 mm) high. Equipment access doorways for all other utility transformers shall be sized to accommodate the transformer placement and as specified by Seattle City Light to allow equipment installation and removal.

Doorways for personnel access shall have clear openings of at least 36 inches (914 mm) wide and 6 feet 8 inches (2057 mm) high.

430.6.2.1 Locks. All doors shall be equipped with locks and shall be kept locked. Doors to *utility transformer vaults* shall be equipped with a cylinder capable of accepting the core provided by the utility. Personnel doors shall be equipped with panic bars, pressure plates, or other devices that are normally latched but open under simple pressure.

430.6.2.2 Oil containment sill. A removable oil containment sill shall be as high as necessary to contain the oil of one transformer but in no case less than 4 inches (203 mm) high or as specified by Seattle City Light for utility transformers. A sill shall be installed within the vault at each doorway after the installation of the transformer.

430.7 Ventilation systems for transformer vaults.

430.7.1 General. Ventilation systems shall be provided to dispose of heat from transformer total losses without creating a temperature rise that exceeds the transformer rating.

430.7.2 Method of ventilation. Ventilation shall be provided by either natural circulation or mechanical circulation.

430.7.2.1 Natural circulation. Transformer vaults containing up to three transformers of no more than 75 kVA each are permitted to be ventilated by natural circulation. The combined minimum net intake and exhaust vent area, exclusive of area occupied by screens, grating or louvers, shall not be less than 3 square inches (1935 mm^2) per kVA of transformer capacity. The total required area shall be divided roughly equally between intake and exhaust. In no case shall either the intake or exhaust area be less than 72 square inches (46 452 mm^2).

Approximately one half the total area required for ventilation openings shall be for intake air. Intake air vents shall be located in one or more openings in the lower portion of the perimeter vault walls. When the vault is located in a garage, any lower openings must be at least 18 inches above the garage floor level. The remaining one-half of the required ventilation area shall be used to exhaust heat through one or more openings in the upper portion of the perimeter walls or roof of the vault. Intake openings shall be located on the opposite side of the vault from exhaust openings allowing air to flow longitudinally over the transformer and out of the vault.

430.7.2.2 Mechanical circulation. Positive or negative pressure ventilation systems shall supply a minimum of 1.6 cfm (0.76 L/s) of air per kVA of transformer capacity. The fans shall be installed outside of the vault and shall be controlled by a thermostat located inside the vault.

The intake vents shall be located in the lower one-half of the perimeter walls of the vault. When the vault is located in a public garage or loading dock, any lower intake openings must be at least 18 inches above the garage floor level and at least 18 inches above the vault floor.

The exhaust vents shall be in the roof or ceiling of the vault. Vents are allowed to be installed in a wall if the top of the vent is not less than 12 inches below the vault ceiling. The top of the outlet on the exterior of the building shall be at least as high as the top of the outlet from the vault.

The ventilation system shall cause air to flow longitudinally across the transformers. The vault ventilation system shall be controlled independently from the rest of the building ventilation.

For *utility transformer vaults*, mechanical ventilation systems shall be designed by the applicant. The capacity and location of the ventilation system shall be *approved* by the Superintendent of Seattle City Light.

430.7.2.3 Temperature control. A remote temperature controller shall be installed in *utility transformer vaults* that have mechanical ventilation systems. The controller shall activate the fan when the temperature in the vault exceeds 70°F (21°C), and shall turn the fan off when the temperature reaches 140°F (60°C).

A visible or audible alarm shall be installed outside each *utility transformer vault* that will be activated if the fan does not operate when the temperature controller calls for ventilation, or if the fan becomes inoperable. A sign shall be mounted near the alarm stating CALL SEATTLE CITY LIGHT WHEN ALARM SOUNDS or CALL SEATTLE CITY LIGHT WHEN LIGHT IS ON.

430.7.3 Ventilation openings and duct terminations. Ventilation openings and duct terminations shall comply with *International Mechanical Code* Section 501.3.1 item 7, unless otherwise *approved* by the *building official*.

430.7.3.1 Location of exhaust ventilation openings and exhaust duct terminations. Exhaust ventilation openings and duct terminations shall be located not less than 10 feet (3048 mm) from fire escapes, required means of egress at the exterior of the building, elements of the exit discharge, combustible exterior wall coverings, openings that are not protected in accordance with Section 705.8, operable openings and property lines other than a public way and above finished walking surfaces. Exhaust outlets shall be located on the exterior of the building.

Interpretation I430.7: For purposes of this section, "property line" includes any property line separating one lot from another lot, but does not include any property line separating a lot from a public street or alley right-of-way. The separation distance may be measured to the opposite side of public streets and alleys.

430.7.3.2 Covering. Ventilation openings shall be covered with durable metal gratings, screens or louvers. If operable intake louvers are provided on mechanically ventilated transformer vaults, the louvers shall be controlled by the fan thermostat; i.e., the louvers shall be opened when the fan is energized.

430.7.3.3 Opening protection. Intake ventilation openings in the vault walls on the interior and exterior of the building shall be protected by automatic closing fire dampers having a fire-protection rating at least equal to that required for the vault. The actuating device on the fire damper shall be made to function at a temperature of 165°F (74°C).

430.7.3.4 Ventilation ducts. Exhaust ventilation ducts, if used, shall be enclosed in construction having a fire-resistance rating at least equal to that required for the vault. Exhaust ducts shall extend from the vault to the outside of the building.

An exhaust duct for a mechanically ventilated vault shall be used exclusively for ventilating the vault. No fire dampers shall be installed in exhaust ventilation ducts.

430.8 Drainage for vaults.

430.8.1 General. Drains are prohibited in all transformer vaults.

430.8.2 Sumps. All transformer vaults containing oil-insulated transformers shall have a dry sump. All sumps shall have an opening of at least 6 inches (152 mm) diameter, a depth of at least 12 inches (305 mm), and shall be equipped with a removable steel grate that is flush with the floor. Sumps shall have at least an 8 gallon (30 liter) capacity. Sump capacity may be greater where required by the utility. The sump shall have a grouted bottom. The sump shall be located near, but not directly behind, the personnel door and shall be out of the entry path for moving transformers in and out of the vault. The vault floor shall slope at least 1 inch in 10 feet (25 mm in 3048 mm) toward the sump.

430.9 Pipes and ducts in transformer vaults. No pipes or ducts foreign to the electrical installation shall enter or pass through any transformer vault. Electrical conduits terminating at transformer vaults shall be sealed with listed three-hour fire-protection rated firestop material. Electrical conduits terminating at transformer vaults shall be installed to avoid channeling water into the vault. Electrical conduits entering the vault floor shall be rigid galvanized steel and shall extend no less than 18 inches (457 mm) into the vault or to the top of the containment sill, whichever is greater.

430.10 Storage in transformer vaults. No material shall be stored in any transformer vault.

430.11 Sprinkler systems. Sprinkler systems shall not be installed within a transformer vault. The vault must be maintained in a dry condition at all times.

CHAPTER 5

GENERAL BUILDING HEIGHTS AND AREAS

User note:

About this chapter: *Chapter 5 establishes the limits to which a building can be built. Building height, number of stories and building area are specified in this chapter. Chapter 5 must be used in conjunction with the occupancies established in Chapter 3 and the types of construction established in Chapter 6. This chapter also specifies the impact that mezzanines, accessory occupancies and mixed occupancies have on the overall size of a building.*

SECTION 501
GENERAL

501.1 Scope. The provisions of this chapter control the height and area of structures hereafter erected and *additions* to *existing structures*.

SECTION 502
BUILDING ADDRESS

[S][F] 502.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of 1/2 inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure. Address identification shall be maintained.

502.1.1 Enforcement by building official. The *building official* shall determine the address of any property in the City in accordance with the numbering system established in this chapter.

Whenever the irregularity of plats, the changing direction of streets, avenues, or other highways, the interruption of the continuity of highways or any other condition causes doubt or difference of opinion as to the correct number of any piece of property or any building thereon, the number shall be determined by the *building official*. The *building official* shall be guided by the specific provisions of this chapter as far as they are applicable and when not applicable, by such rules as are established to carry out the intent of this chapter.

502.1.1.1 Owners to affix and maintain building numbers. The owner of any *building* or other structure shall maintain the street number of each *building* and structure in a conspicuous place over or near the principal street entrance or entrances, or in other conspicuous places as is necessary for the easy locating of such address.

Exception: Where there are multiple *buildings* on a site, the *building official* is permitted to waive the requirement for posting an address on appurtenant or accessory buildings where individual identification of each building is not essential.

Where a property has frontage along more than one named street, or for any other property, where there may be confusion regarding the address of a *building* or *structure*, the *building official* is permitted to require the complete address, including street number and street name to be conspicuously posted.

For *buildings* served by a private road or a common driveway, the address number(s) shall be posted at the head of the road or driveway in a manner that can be easily read from the intersecting street. Where the existing street grid may not adequately allow for the assignment of street addresses that will promote the easy locating of such addresses, or for any other reason consistent with the intent of this chapter, the *building official* is permitted to assign a name to the private road or common driveway that shall be used for addressing purposes. In addition, the *building official* is permitted to require one or more property owners along the road or driveway to post a sign displaying the assigned name at a location near the intersection of the road or driveway with a named public street.

If the *building official* finds that a *building*, structure or premises is not provided with numbers as herein required, or is not correctly numbered, the *building official* is permitted to notify the owner, agent or tenant of the correct street number and require that the number be properly placed, in accordance with the provisions of this chapter, within a reasonable length of time. It is a violation of this code for any *person* to fail to comply with such notice.

502.1.2 Numbering system prescribed. The numerical designation of all doorways and entrances to buildings and lots fronting upon the named right-of-ways of the City are established in accordance with the following system:

Except where otherwise specified, 100 numbers are allotted to each block, provided that where a named right-of-way intervenes between consecutively numbered right-of-ways, 50 numbers shall be allotted for each block. One whole number is allotted to each 20 feet (6096 mm) of frontage in each block; even numbers shall be used on the northerly side of named right-of-ways extending in an easterly and westerly direction and on the easterly side of named right-of-ways extending in a northerly and southerly direction. Odd numbers shall be used on the southerly side of named right-of-ways extending in an easterly and westerly direction and on the westerly side of named right-of-ways extending in a northerly and southerly direction.

In the case of irregular named right-of-ways, the frontages shall be numbered as near as may be according to the uniform series of block numbers with which they most nearly correspond.

502.1.3 Numbering of buildings

502.1.3.1 Numbering of buildings downtown. Between Yesler Way and Denny Way all frontages upon named right-of-ways extending in a northerly and southerly direction and lying west of Broadway, East Union Street, Minor Avenue and Melrose Avenue shall be numbered as follows:

Yesler Way to Fir Street number 100 and upwards, Fir Street to Spruce Street number 150 and upwards, Spruce Street to Alder Street number 200 and upwards, continuing by consecutive hundreds to Pine Street; Pine Street to Olive Way number 1600 and upwards, Olive Way to Howell Street number 1700 and upwards, Howell Street to Stewart Street number 1800 and upwards, Stewart Street to Virginia Street number 1900 and upwards, continuing by consecutive hundreds to Denny Way.

Between East Yesler Way and East Denny Way all frontages upon named right-of-ways extending in a northerly and southerly direction and lying east of Broadway, East Union Street, Minor Avenue and Melrose Avenue shall be numbered as follows:

East Yesler Way to East Fir Street number 100 and upwards, East Fir Street to East Spruce Street number 150 and upwards, East Spruce Street to East Alder Street number 200 and upwards, continuing by consecutive hundreds to East Marion Street; East Marion Street to East Spring Street number 900 and upwards, East Spring Street to East Union Street number 1100 and upwards, East Union Street to East Pike Street number 1400 and upwards, continuing by consecutive hundreds to East Denny Way.

Between East Yesler Way and East Denny Way all frontages upon named right-of-ways extending in an easterly and westerly direction and lying west of Broadway, East Union Street, Minor Avenue and Melrose Avenue shall be numbered as follows:

Southwesterly from Elliott Avenue, or Alaskan Way if south of Lenora Street, number 51 and downwards; Elliott Avenue (or Alaskan Way) to Western Avenue number 52 and upwards; Western Avenue to First Avenue number 76 and upwards; First Avenue to Second Avenue number 100 and upwards, continuing northeasterly to Broadway, East Union Street, Minor Avenue, or Melrose Avenue by consecutive hundreds.

Between East Yesler Way and East Denny Way all frontages upon named right-of-ways extending in an easterly and westerly direction and lying east of Broadway, East Union Street, Minor Avenue and Melrose Avenue shall be numbered as follows:

Melrose Avenue to Bellevue Avenue number 300 and upwards, Bellevue Avenue to Summit Avenue number 400 and upwards, continuing by consecutive hundreds to Broadway.

Broadway to Tenth Avenue number 900 and upwards, Tenth Avenue to Eleventh Avenue number 1000 and upwards, continuing by consecutive hundreds corresponding with the numbered series of avenues eastward to Lake Washington.

On East Olive Way eastward from Melrose Avenue, the street numbers shall run upwards consecutively, eastward from the existing street numbers that are west of the Melrose Avenue intersection.

502.1.3.2 Numbering of buildings south of downtown and east of the East Waterway. South of Yesler Way the frontages upon the named right-of-ways extending in a northerly and southerly direction shall be numbered as follows:

Yesler Way (or East Yesler Way) to South Washington Street number 100 and upwards, South Washington Street to South Main Street number 200 and upwards, South Main Street to South Jackson Street number 300 and upwards, South Jackson Street to South King Street number 400 and upwards, continuing by consecutive hundreds to South Barton Place, with blocks and streets on Rainier Avenue South being taken as the controlling series.

South of South Barton Place, 51st Avenue South shall be taken as the controlling series to the southern City limits.

On Second Avenue Extension South from Fourth Avenue South to Yesler Way, the frontages shall be numbered as follows:

From Fourth Avenue South to South Jackson Street number 100 and upwards, South Jackson Street to South Main Street number 200 and upwards, South Main Street to South Washington Street number 300 and upwards, South Washington Street to Yesler Way number 400 and upwards.

South of Yesler Way the frontages upon named right-of-ways extending in an easterly and westerly direction shall be numbered as follows:

Westward from First Avenue South to the Harbor Line or East Waterway number 99 and downwards, First Avenue South to Occidental Avenue South number 100 and upwards, Occidental Avenue South to Second Avenue South number 150 and upwards, Second Avenue South to Third Avenue South number 200 and upwards, continuing by consecutive hundreds to Sixth Avenue South; Sixth Avenue South to Maynard Avenue South number 600 and upwards, Maynard Avenue South to Seventh Avenue South number 650 and upwards, Seventh Avenue South to Eighth Avenue South (or Airport Way south of South Hinds Street) number 700 and upwards, Eighth Avenue South (or Airport Way south of South Hinds Street) to Airport Way South (or Ninth Avenue South of South Hinds Street) number 800 and upwards, Airport Way South (or Ninth Avenue South of South Hinds Street) to Interstate Highway 5 number 900 and upwards, continuing eastward by consecutive hundreds corresponding with the numbered series of avenues to Lake Washington.

502.1.3.3 Numbering of buildings between downtown and the Lake Washington Ship Canal. North of Denny Way, East Denny Way, and East Howell Street east of Madrona Drive the frontages upon the named right-of-ways extending in a northerly and southerly direction shall be numbered as follows:

Denny Way (and East or West Denny Way) to John Street (and East or West John Street) number 100 and upwards, continuing by consecutive hundreds, the blocks and streets on Queen Anne Avenue North being taken as a controlling series for numbering purposes west of Fairview Avenue North (or Fairview Avenue East) and south of Bertona Street (or West Bertona Street); 36th Avenue West being taken as the controlling series for numbering purposes west of Fairview Ave North (or Fairview Ave East) and north of Bertona Street (or West Bertona Street); Tenth Avenue East being taken as the controlling series for numbering purposes east of Fairview Avenue North (or Fairview Avenue East).

Between Queen Anne Avenue North and Eastlake Avenue East (East Galer being the northeast boundary of this subsection) the frontages on the named right-of-ways extending in an easterly and westerly direction shall be numbered as follows:

Queen Anne Avenue North to First Avenue North number 1 and upwards, First Avenue North to Warren Avenue North number 100 and upwards, Warren Avenue North to Second Avenue North number 150 and upwards, Second Avenue North to Third Avenue North number 200 and upwards, continuing by consecutive hundreds corresponding to the numbered series of avenues with half hundreds in the case of Nob Hill, Taylor, Bigelow, Mayfair, and Dexter Avenues North, to Ninth Avenue North; Ninth Avenue North to Westlake Avenue North number 900 and upwards, Westlake Avenue North to Terry Avenue North number 950 and upwards, Terry Avenue North to Boren Avenue North number 1000 and upwards, Boren Avenue North to Fairview Avenue North number 1100 and upwards, Fairview Avenue North to Minor Avenue North number 1150 and upwards, Minor Avenue North to Pontius Avenue North number 1200 and upwards, Pontius Avenue North to Yale Avenue North number 1250 and upwards, Yale Avenue North to Eastlake Avenue East number 1300 and upwards.

East of Eastlake Avenue East (or Fairview Avenue East north of East Galer Street) and North of East Denny Way the frontages upon the named east-west right-of-ways extending in an easterly and westerly direction shall be numbered as follows:

Eastlake Avenue East to Melrose Avenue East number 200 and upwards continuing by consecutive hundreds eastward to Broadway East; Broadway East to Tenth Avenue East number 900 and upwards, Tenth Avenue East to Federal Avenue East number 1000 and upwards, Federal Avenue East to Eleventh Avenue East number 1050 and upwards, Eleventh Avenue East to Twelfth Avenue East number 1100 and upwards, continuing by consecutive hundreds eastward to Lake Washington.

West of Queen Anne Avenue North the frontages upon named east-west right-of-ways extending in an easterly and westerly direction shall be numbered westward as follows:

Queen Anne Avenue North to First Avenue West number 1 and upwards, First Avenue West to Second Avenue West number 100 and upwards, continuing by consecutive hundreds westward.

502.1.3.4 Numbering of buildings north of the Lake Washington Ship Canal. The plan for the numbering of frontages upon the various named right-of-ways in that portion of the City of Seattle lying north of the Lake Washington Ship Canal is established as follows:

The frontages upon the named right-of-ways extending in a northerly and southerly direction shall be numbered in accordance with the designations of the intersecting numbered streets as follows: northward from the State Harbor Line, number 2900 and upwards.

The frontages upon the named right-of-ways extending in an easterly and westerly direction shall be numbered as follows:

West from First Avenue Northwest, commencing with 100, and continuing west in correspondence with the numbers of the avenues to Puget Sound.

East from First Avenue Northwest, commencing with 100 and continuing as follows: East from Palatine Avenue North, 200 and upwards; from Greenwood Avenue North, 300 and upwards; from Phinney Avenue North, 400 and upwards; from Francis Avenue North, 450 and upwards; from Dayton Avenue North, 500 and upwards; from Evanston Avenue North, 600 and upwards; from Fremont Avenue North, 700 and upwards; from North Park Avenue North, 800 and upwards; from Linden Avenue North, 900 and upwards (800 and upwards south of North 65th Street); from Aurora Avenue North, 900 and upwards (1100 and upwards north of North 65th Street); from Winslow Place North, 950 and upwards; from Whitman Avenue North 1000 and upwards; from Albion Place North, 1050 and upwards; from Woodland Park Avenue North, 1100 and upwards; from Nesbit Avenue North, 1150 and upwards; from Midvale Avenue North, 1200 and upwards; from Lenora Place North, 1250 and upwards; from Stone Avenue North (Stone Way North south of North 46th Street), 1300 and upwards; from Interlake Avenue North, 1400 and upwards; from Ashworth Avenue North, l500 and upwards; from Carr Place North, 1550 and upwards; from Woodlawn Avenue North, 1600 and upwards, from Densmore Avenue North, 1700 and upwards; from Caroline Avenue North and Courtland Place North, 1750 and upwards; from Wallingford Avenue North, 1800 and upwards; from Burke Avenue North and Canfield Place North, 1900 and upwards; From Stroud Avenue North and Wayne Place North, 2000 and upwards; from Meridian Avenue North, 2100 and upwards; from Bagley Avenue North, 2200 and upwards; from Corliss Avenue North, 2300 and upwards; from Sunnyside Avenue North, 2400 and upwards; and from Eastern Avenue North, 2500 and upwards.

East from First Avenue Northeast, commencing with 100, and continuing east in correspondence with the numbered avenues to Lake Washington.

502.1.3.5 Numbering buildings on Harbor Island. The frontages upon named right-of-ways extending in a northerly and southerly direction shall be numbered as follows:

Southwest Massachusetts Street to Southwest Florida Street, number 1700 and upwards; Southwest Florida Street to Southwest Lander Street, number 2500 and upwards; Southwest Lander Street to Southwest Hanford Street, number 2700 and upwards; Southwest Hanford Street to Southwest Spokane Street, number 3200 and upwards.

The frontages upon named right-of-ways extending in an easterly and westerly direction shall be numbered as follows:

The East Waterway to 11th Avenue Southwest, number 900 and upwards; 11th Avenue Southwest to 13th Avenue Southwest, number 1100 and upwards; 13th Avenue Southwest to 16th Avenue Southwest, number 1300 and upwards; 16th Avenue Southwest to the West Waterway, number 1600 and upwards.

502.1.3.6 Numbering buildings west of the West Waterway and the Duwamish Waterway. The frontages upon named right-of-ways extending in a northerly and southerly direction, shall be numbered as follows:

North of Southwest Andover Street, commencing with 3800 and continuing north to the Duwamish Head by consecutive hundreds, the blocks and streets on California Avenue Southwest being taken as the controlling series for numbering purposes.

South of Southwest Andover Street, commencing with 4000 and continuing south to Southwest Roxbury Street by consecutive hundreds, the blocks and streets of California Avenue Southwest being taken as the controlling series for numbering purposes.

South of Southwest Roxbury Street, commencing with 9600 and continuing south to the south City limits by consecutive hundreds, in correspondence with the numbers of the intersecting streets.

The frontages upon named right-of-ways extending in an easterly and westerly direction, shall be numbered as follows:

West of California Avenue Southwest, commencing with 4300 and continuing westward in correspondence with the numbers of the intersecting avenues to Puget Sound.

East of California Avenue Southwest, commencing with 4200 and continuing eastward in correspondence with the numbers of the intersecting avenues to the Duwamish Waterway.

SECTION 503
GENERAL BUILDING HEIGHT AND AREA LIMITATIONS

503.1 General. Unless otherwise specifically modified in Chapter 4 and this chapter, *building height*, number of *stories* and *building area* shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. *Building height*, number of

stories and *building area* provisions shall be applied independently. For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered to be a separate building.

503.1.1 Special industrial occupancies. Buildings and structures designed to house special industrial processes that require large areas and unusual *building heights* to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the *building height*, number of *stories* and *building area* limitations specified in Sections 504 and 506.

503.1.2 Buildings on same lot. Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building where the *building height*, number of *stories* of each building and the aggregate *building area* of the buildings are within the limitations specified in Sections 504 and 506. The provisions of this code applicable to the aggregate building shall be applicable to each *building*.

503.1.3 Type I construction. Buildings of Type I construction permitted to be of unlimited tabular *building heights and areas* are not subject to the special requirements that allow unlimited area buildings in Section 507 or unlimited *building height* in Sections 503.1.1 and 504.3 or increased *building heights and areas* for other types of construction.

503.1.4 Occupied roofs. A roof level or portion thereof shall be permitted to be used as an occupied roof provided the occupancy of the roof is an occupancy that is permitted by Table 504.4 for the *story* immediately below the roof. The area of the occupied roofs shall not be included in the *building area* as regulated by Section 506. An occupied roof shall not be included in the *building height* or number of *stories* as regulated by Section 504, provided that the *penthouses* and other enclosed *rooftop structures* comply with Section 1511.

Exceptions:

1. The occupancy located on an occupied roof shall not be limited to the occupancies allowed on the *story* immediately below the roof where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and occupant notification in accordance with Sections 907.5.2.1 and 907.5.2.3 is provided in the area of the occupied roof. *Emergency voice/alarm communication* system notification per Section 907.5.2.2 shall also be provided in the area of the occupied roof where such system is required elsewhere in the building.
2. Assembly occupancies shall be permitted on roofs of open parking spaces of Type I or Type II construction, in accordance with the exception to Section 903.2.1.6.

[W][S] 503.1.4.1 ((~~Enclosures over~~)) Enclosure of occupied roof areas. Elements or structures enclosing the occupied roof areas shall not extend more than 48 inches (1220 mm) above the surface of the occupied roof.

Exceptions:

1. *Penthouses* constructed in accordance with Section 1511.2 and towers, domes, spires and cupolas constructed in accordance with Section 1511.5.
2. High rise buildings.

[W] 503.1.4.2 Guards. Occupied roofs shall have guards in accordance with Section 1015.2.

SECTION 504
BUILDING HEIGHT AND NUMBER OF STORIES

504.1 General. The height, in feet, and the number of *stories* of a building shall be determined based on the type of construction, occupancy classification and whether there is an *automatic sprinkler system* installed throughout the building.

Exception: The *building height* of one-*story* aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited where the building is provided with an *automatic sprinkler system* or *automatic fire-extinguishing system* in accordance with Chapter 9 and is entirely surrounded by *public ways* or *yards* not less in width than one and one-half times the *building height*.

504.1.1 Unlimited area buildings. The height of unlimited area buildings shall be designed in accordance with Section 507.

504.1.2 Special provisions. The special provisions of Section 510 permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in Section 510.

504.2 Mixed occupancy. In a building containing mixed occupancies in accordance with Section 508, no individual occupancy shall exceed the height and number of *story* limits specified in this section for the applicable occupancies.

504.3 Height in feet. The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3.

Exception: Towers, spires, steeples and other *rooftop structures* shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1511.2.4. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height where of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable *building height* where of combustible materials (see Chapter 15 for additional requirements).

[W][S] TABLE 504.3[j]
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S[i]	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the *International Existing Building Code*.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. I-1, Condition 2 Assisted living facilities licensed per chapter 388-78A WAC and residential treatment facilities as licensed by Washington State under chapter 246-337 WAC shall be permitted to use the allowable height above grade plane for R-2 occupancies.
j. A maximum of 12 inches of insulation may be added to the roof of an *existing building* without such additional height contributing to the *building height*.

504.4 Number of stories. The maximum number of *stories above grade plane* of a building shall not exceed the limits specified in Table 504.4.

[W] TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	9	6	4	4	3	2
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2
F-1	NS	UL	11	4	2	3	2	3	3	3	4	2	1
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	12	8	6	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c, d]	UL	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS[c, d]	UL	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS[c, d]	UL	7	5	3	5	3	5	5	5	5	3	2
	S	UL	8	6	4	6	4	8	7	6	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	4	4	4	3	2
	S	UL	10	5	4	5	4	10	7	5	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S[i]	UL	10	5				10	6	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				7	5	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	7	5	3	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	12	8	6	5	4	2
R-1[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	((~~3~~)) 4	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	18	12	8	5	((~~4~~)) 5	3

[W] TABLE 504.4—continued
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
R-2[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	((3)) 4	2
	S13R	4	4	4								4	3
	S	UL	12	5	5	5	5	18	12	8	5	((4)) 5	3
R-3[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	((3)) 4	3
	S13D	4	4									3	3
	S13R	4	4									4	4
	S	UL	12	5	5	5	5	18	12	5	5	((4)) 5	4
R-4[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13D	4	4									3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	18	12	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1
	S	UL	12	5	4	4	4	10	7	5	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	4	5	4	2
	S	UL	12	6	4	5	4	12	8	5	6	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	9	6	5	5	3	2

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing *building height* in accordance with the *International Existing Building Code*.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. Group I-1, Condition 2. Assisted living facilities licensed per chapter 388-78A WAC and residential treatment facilities as licensed by Washington State under chapter 246-337 WAC shall be permitted to use the allowable number of stories above grade plane for R-2 occupancies.

SECTION 505
MEZZANINES AND EQUIPMENT PLATFORMS

[W] 505.1 General. *Mezzanines* shall comply with Section 505.2. *Equipment platforms* shall comply with Section 505.3.

Exception: Lofts in Group R occupancy dwelling units and sleeping units shall be permitted to comply with Section 420.14, subject to the limitations in Section 420.14.1.

Interpretation I505.1: *Mezzanines* within individual *dwelling units* shall not be located above other *dwelling units* or common space other than corridors.

[S] 505.2 Mezzanines. A *mezzanine* or *mezzanines* in compliance with Section 505.2 shall be considered a portion of the *story* below. Such *mezzanines* shall not contribute to either the *building area* or number of *stories* as regulated by Section 503.1. The area of the *mezzanine* shall be included in determining the *fire area*. The clear height above and below the *mezzanine* floor construction shall be not less than 7 feet (2134 mm).

505.2.1 Area limitation. The aggregate area of a *mezzanine* or *mezzanines* within a room shall be not greater than ((~~one-third~~)) one-half of the floor area of that room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the *mezzanine* is located. In determining the allowable *mezzanine* area, the area of the *mezzanine* shall not be included in the floor area of the room.

((~~Exceptions~~)) Exception: ((~~1.~~)) The aggregate area of *mezzanines* in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section 503.1.1 shall be not greater than two-thirds of the floor area of the room.

((~~2. The aggregate area of *mezzanines* in buildings and structures of Type I or II construction shall be not greater than one-half of the floor area of the room in buildings and structures equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1 and an *approved emergency voice/alarm communication system* in accordance with Section 907.5.2.2.~~

~~3. The aggregate area of a *mezzanine* within a *dwelling unit* that is located in a building equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 shall not be greater than one-half of the floor area of the room, provided that:~~

~~3.1. Except for enclosed closets and bathrooms, the *mezzanine* shall be open to the room in which such *mezzanine* is located;~~

~~3.2. The opening to the room shall be unobstructed except for walls not more than 42 inches (1067 mm) in height, columns and posts; and~~

~~3.3. Exceptions to Section 505.2.3 shall not be permitted.~~))

Interpretation I505.2: Only the following unenclosed areas of the room or space containing the *mezzanine* shall be used for purposes of calculating the allowable *mezzanine* floor area:

1. Areas with a ceiling height of at least 7 feet located directly below the mezzanine, except that no additional area benefit shall be gained for stacked *mezzanines;* and
2. Areas where the ceiling has a slope of less than 2:12 and with a ceiling height of at least 14 feet plus the thickness of the *mezzanine* floor construction; and
3. Areas where the ceiling has a slope of 2:12 or more and has a ceiling height of at least 12 feet plus the thickness of the *mezzanine* floor construction, provided that the *mezzanine* complies with Section 1208.2, exception 2.

Within a *dwelling unit*, enclosed or unenclosed portions of the entire floor level containing the *mezzanine* that meet requirements of this interpretation for the room area may be used for purposes of calculating the allowable *mezzanine* floor area.

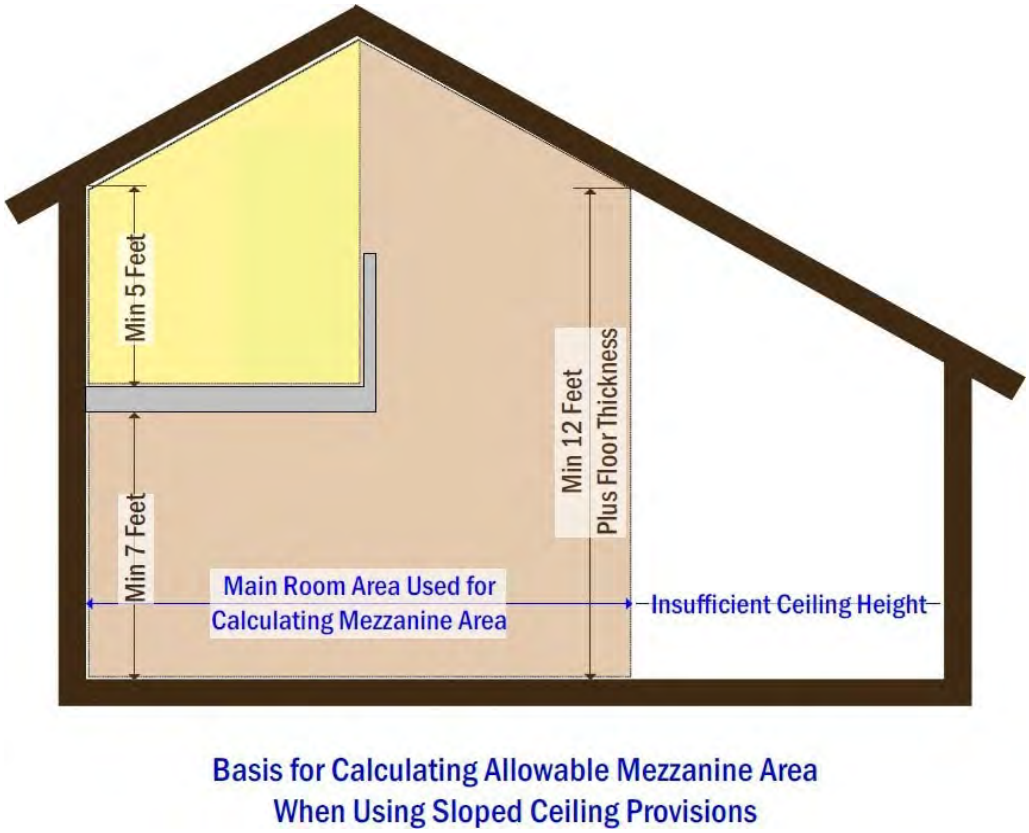


FIGURE I505.2(1)
BASIS FOR CALCULATING ALLOWABLE MEZZANINE AREA WHEN USING SLOPED CEILING PROVISIONS

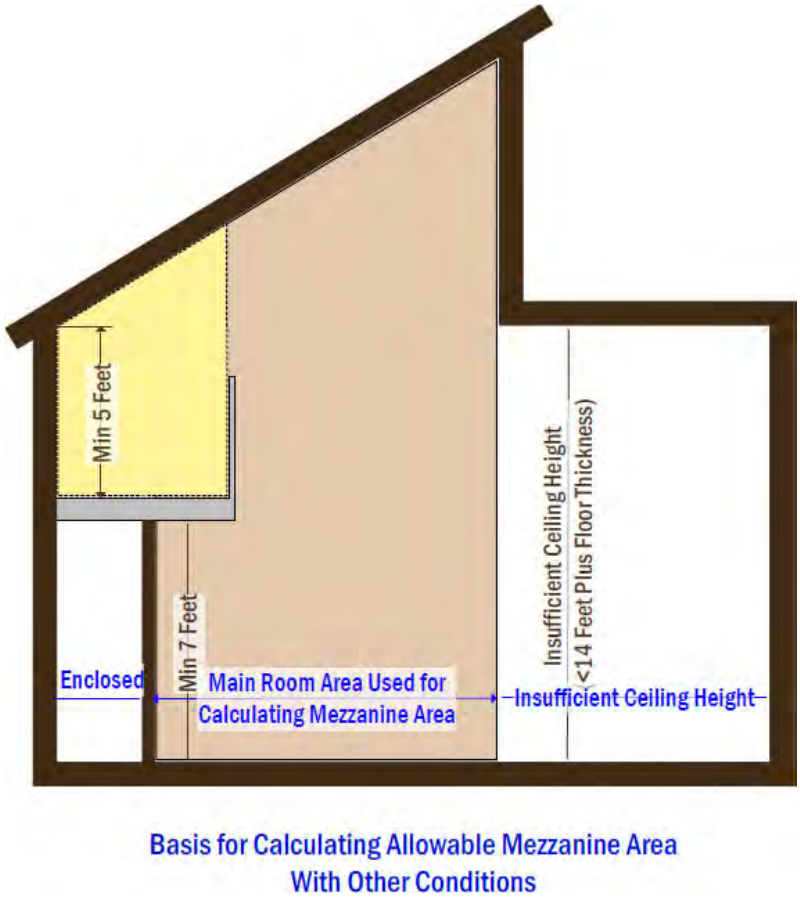


FIGURE I505.2(2)
BASIS FOR CALCULATING ALLOWABLE MEZZANINE AREA WITH OTHER CONDITIONS

505.2.1.1 Aggregate area of mezzanines and equipment platforms. Where a room contains both a *mezzanine* and an *equipment platform*, the aggregate area of the two raised floor levels shall be not greater than two-thirds of the floor area of that room or space in which they are located. The area of the *mezzanine* shall not exceed the area determined in accordance with Section 505.2.1.

505.2.2 Means of egress. The *means of egress* for *mezzanines* shall comply with the applicable provisions of Chapter 10.

505.2.3 Openness. A *mezzanine* shall be open and unobstructed to the room in which such *mezzanine* is located except for walls not more than 42 inches (1067 mm) in height, columns and posts.

Exceptions:

1. *Mezzanines* or portions thereof are not required to be open to the room in which the *mezzanines* are located, provided that the *occupant load* of the aggregate area of the enclosed space is not greater than 10.
2. A *mezzanine* having two or more exits or access to exits is not required to be open to the room in which the *mezzanine* is located.
3. *Mezzanines* or portions thereof are not required to be open to the room in which the *mezzanines* are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the allowable *mezzanine* area.
4. In industrial facilities, *mezzanines* used for control equipment are permitted to be glazed on all sides.
5. In occupancies other than Groups H and I, which are no more than two *stories* above grade plane and equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, a *mezzanine* having two or more *exits* or *access to exits* shall not be required to be open to the room in which the *mezzanine* is located.

[S] 505.3 Equipment platforms. ((~~*Equipment platforms* in buildings shall not be considered as a portion of the floor below. Such *equipment platforms* shall not contribute to either the *building area* or the number of *stories* as regulated by Section 503.1. The area of the *equipment platform* shall not be included in determining the *fire area* in accordance with Section 903. *Equipment platforms* shall not be a part of any *mezzanine* and such platforms and the walkways, *stairways, alternating tread*~~

~~*devices* and ladders providing access to an *equipment platform* shall not serve as a part of the *means of egress* from the building.~~)) Equipment platforms and building elements supporting only the platform shall be built of materials permitted for the type of construction of the building. *Equipment platforms* in building shall not:

1. Be considered as a portion of the floor below.
2. Contribute to either the *building area* or the number of *stories* as regulated by Section 503.1.
3. Be included in determining the *fire area* in accordance with Section 903.
4. Be a part of any *mezzanine*.
5. Serve as a part of the *means of egress* from the building, including the walkways, *stairs*, *alternating tread devices* and ladders providing access to an equipment platform.

505.3.1 Area limitation. The aggregate area of all *equipment platforms* within a room shall be not greater than two-thirds of the area of the room in which they are located. Where an *equipment platform* is located in the same room as a *mezzanine*, the area of the *mezzanine* shall be determined by Section 505.2.1 and the combined aggregate area of the *equipment platforms* and *mezzanines* shall be not greater than two-thirds of the room in which they are located. The area of the *mezzanine* shall not exceed the area determined in accordance with Section 505.2.1.

505.3.2 Automatic sprinkler system. Where located in a building that is required to be protected by an *automatic sprinkler system*, *equipment platforms* shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in Section 903.3.

505.3.3 Guards. *Equipment platforms* shall have *guards* where required by Section 1015.2.

SECTION 506
BUILDING AREA

[S] 506.1 General. The allowable floor area of a building shall be determined based on the type of construction, occupancy classification, whether there is an *automatic sprinkler system* installed throughout the building and the amount of building frontage on *public way* or open space.

506.1.1 Unlimited area buildings. Unlimited area buildings shall be designed in accordance with Section 507.

506.1.2 Special provisions. The special provisions of Section 510 permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in Section 510.

506.1.3 Basements. *Basements* need not be included in the total allowable floor area of a building provided the total area of such *basements* does not exceed the area permitted for a one-*story above grade plane* building.

506.2 Allowable area determination. The allowable area of a building shall be determined in accordance with the applicable provisions of Sections 506.2.1, 506.2.2 and 506.3.

506.2.1 Single-occupancy buildings. The allowable area of each *story* of a single-occupancy building shall be determined in accordance with Equation 5-1:

$$A_a = A_t + (NS \times I_f) \quad \textbf{(Equation 5-1)}$$

where:

A_a = Allowable area (square feet).
A_t = Tabular allowable area factor (NS, S1, S13R or S13D value, as applicable) in accordance with Table 506.2.
NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether the building is sprinklered).
I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

The allowable area per story of a single-occupancy building with a maximum of three stories above grade shall be determined by Equation 5-1. The total allowable area of a single-occupancy building more than three *stories above grade plane* shall be determined in accordance with Equation 5-2:

$$A_a = [A_t + (NS \times I_f)] \times S_a \quad \textbf{(Equation 5-2)}$$

where:

A_a = Allowable area (square feet).
A_t = Tabular allowable area factor (NS, S13R, S13D or SM value, as applicable) in accordance with Table 506.2.

NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building (regardless of whether the building is sprinklered).

I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

S_a = 3 where the actual number of stories above grade plane exceeds three, or

S_a = 4 where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2.

The actual area of any individual floor shall not exceed the allowable area per Equation 5-1.

[W][S] TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1												
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP
	S1												
H-2	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000
	S1												
	SM												
H-3	NS[c]	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000
	S1												
	SM												
H-4	NS[c, d]	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
	SM	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
H-5	NS[c, d]	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108000	54,000	27,000

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

[W][S] TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
I-1	NS[d, e]	UL	55,000	19,000	10,000	16,500	10,000	54,000	36,000	18,000	18,000	10,500	4,500
	S1	UL	220,000	76,000	40,000	66,000	40,000	216,000	144,000	72,000	72,000	42,000	18,000
	SM	UL	165,000	57,000	30,000	49,500	30,000	162,000	108,000	54,000	54,000	31,500	13,500
I-2	NS[d, f]	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
I-3	NS[d, e]	UL	UL	15,000	10,000	10,500	7,500	36,000	24,000	12,000	12,000	7,500	5,000
	S1	UL	UL	60,000	40,000	42,000	30,000	144,000	96,000	48,000	48,000	30,000	20,000
	SM	UL	UL	45,000	30,000	31,500	22,500	108,000	72,000	36,000	36,000	22,500	15,000
I-4	NS[d, g]	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	26,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000
R-1[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3[h]	NS[d]	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13D												
	S13R												
	S1												
	SM												
((~~R-4[h]~~	~~NS[d]~~	~~UL~~	~~UL~~	~~24,000~~	~~16,000~~	~~24,000~~	~~16,000~~	~~61,500~~	~~41,000~~	~~25,625~~	~~20,500~~	~~12,000~~	~~7,000~~
	~~S13D~~												
	~~S13R~~												
	~~S1~~	~~UL~~	~~UL~~	~~96,000~~	~~64,000~~	~~96,000~~	~~64,000~~	~~246,000~~	~~164,000~~	~~102,500~~	~~82,000~~	~~48,000~~	~~28,000~~
	~~SM~~	~~UL~~	~~UL~~	~~72,000~~	~~48,000~~	~~72,000~~	~~48,000~~	~~184,500~~	~~123,000~~	~~76,875~~	~~61,500~~	~~36,000~~	~~21,000~~))
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS[i]	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	162,000	108,000	67,500	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m^2.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable area in this chapter.

b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.

c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building area in accordance with the *International Existing Building Code*.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

506.2.2 Mixed-occupancy buildings. The allowable area of each *story* of a mixed-occupancy building shall be determined in accordance with the applicable provisions of, Section 508.3.2 for nonseparated occupancies and Section 508.4.2 for separated occupancies.

For buildings with more than three *stories above grade plane,* the total *building area* shall be such that the aggregate sum of the ratios of the actual area of each *story* divided by the allowable area of such stories, determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed three.

$$A_a = [A_t + (NS \times I_f)] \quad \textbf{(Equation 5-3)}$$

A_a = Allowable area (square feet).
A_t = Tabular allowable area factor (*NS*, S13R, S13D or SM value, as applicable) in accordance with Table 506.2.
NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building, regardless of whether the building is sprinklered.
I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

Exception: For buildings designed as separated occupancies under Section 508.4 and equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed four.

506.2.2.1 Group H-2 or H-3 mixed occupancies. For a building containing Group H-2 or H-3 occupancies, the allowable area shall be determined in accordance with Section 508.4.2, with the *automatic* sprinkler system increase applicable only to the portions of the building not classified as Group H-2 or H-3.

506.3 Frontage increase. Every building shall adjoin or have access to a *public way* to receive an area factor increase based on frontage. Area factor increase shall be determined in accordance with Sections 506.3.1 through 506.3.3.

506.3.1 Minimum percentage of perimeter. To qualify for an area factor increase based on frontage, a building shall have not less than 25 percent of its perimeter on a *public way* or open space. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved *fire lane*.

506.3.2 Minimum frontage distance. To qualify for an area factor increase based on frontage, the *public way* or open space adjacent to the building perimeter shall have a minimum distance *(W)* of 20 feet (6096 mm) measured at right angles from the building face to any of the following:

1. The closest interior lot line.
2. The entire width of a street, alley or *public way*.
3. The exterior face of an adjacent building on the same property.

The frontage increase shall be based on the smallest *public way* or open space that is 20 feet (6096 mm) or greater, and the percentage of building perimeter having a minimum 20 feet (6096 mm) *public way* or open space.

506.3.3 Amount of increase. The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.

TABLE 506.3.3
FRONTAGE INCREASE FACTOR[a]

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)			
	0 to less than 20	20 to less than 25	25 to less than 30	30 or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.50	0.63	0.75

a. Interpolation is permitted.

506.3.3.1 Section 507 buildings. Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot (18 288 mm) *public way* or *yard* requirement, the area factor increase based on frontage shall be determined in accordance with Table 506.3.3.1.

TABLE 506.3.3.1
SECTION 507 BUILDINGS[a]

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)					
	30 to less than 35	35 to less than 40	40 to less than 45	45 to less than 50	50 to less than 55	55 to less than 60
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.50
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75 to 100	0.88	1.00	1.13	1.25	1.38	1.50

a. Interpolation is permitted.

SECTION 507
UNLIMITED AREA BUILDINGS

507.1 General. The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.13 shall not be limited. Basements not more than one *story* below *grade plane* shall be permitted.

507.1.1 Accessory occupancies. Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.3 through 507.13 shall be applied, where applicable.

507.2 Measurement of open spaces. Where Sections 507.3 through 507.13 require buildings to be surrounded and adjoined by *public ways* and *yards*, those open spaces shall be determined as follows:

1. *Yards* shall be measured from the building perimeter in all directions to the closest interior *lot lines* or to the exterior face of an opposing building located on the same *lot*, as applicable.
2. Where the building fronts on a *public way*, the entire width of the *public way* shall be used.

507.2.1 Reduced open space. The *public ways* or *yards* of 60 feet (18 288 mm) in width required in Sections 507.3, 507.4, 507.5, 507.6 and 507.12 shall be permitted to be reduced to not less than 40 feet (12 192 mm) in width, provided that the following requirements are met:

1. The reduced width shall not be allowed for more than 75 percent of the perimeter of the building.
2. The *exterior walls* facing the reduced width shall have a *fire-resistance rating* of not less than 3 hours.
3. Openings in the *exterior walls* facing the reduced width shall have opening protectives with a *fire protection rating* of not less than 3 hours.

507.3 Nonsprinklered, one-story buildings. The area of a Group F-2 or S-2 building not more than one *story* in height shall not be limited where the building is surrounded and adjoined by *public ways* or *yards* not less than 60 feet (18 288 mm) in width.

507.4 Sprinklered, one-story buildings. The area of a Group A-4 building not more than one *story above grade plane* of other than Type V construction, or the area of a Group B, F, M or S building no more than one *story above grade plane* of any construction type, shall not be limited where the building is provided with an *automatic sprinkler system* throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by *public ways* or *yards* not less than 60 feet (18 288 mm) in width.

Exceptions:

1. Buildings and structures of Type I or II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.4 and 903.3.1.1 and Chapter 32 of the *International Fire Code*.
2. The *automatic sprinkler system* shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that the following criteria are met:
   2.1. *Exit* doors directly to the outside are provided for occupants of the participant sports areas.
   2.2. The building is equipped with a *fire alarm system* with *manual fire alarm boxes* installed in accordance with Section 907.
   2.3. An *automatic sprinkler system* is provided in storage rooms, press boxes, concession booths or other spaces ancillary to the sport activity space.

507.9 Unlimited mixed occupancy buildings with Group H-5. The area of a Group B, F, H-5, M or S building not more than two *stories above grade plane* shall not be limited where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, and is surrounded and adjoined by *public ways* or *yards* not less than 60 feet (18 288 mm) in width, provided that the following criteria are met:

1. Buildings containing Group H-5 occupancy shall be of Type I or II construction.
2. Each area used for Group H-5 occupancy shall be separated from other occupancies as required in Sections 415.11 and 508.4.
3. Each area used for Group H-5 occupancy shall not exceed the maximum allowable area permitted for such occupancies in Section 503.1 including modifications of Section 506.

   Exception: Where the Group H-5 occupancy exceeds the maximum allowable area, the Group H-5 shall be subdivided into areas that are separated by 2-hour *fire barriers.*

507.10 Aircraft paint hangar. The area of a Group H-2 aircraft paint hangar not more than one *story above grade plane* shall not be limited where such aircraft paint hangar complies with the provisions of Section 412.5 and is surrounded and adjoined by *public ways* or *yards* not less in width than one and one-half times the *building height*.

507.11 Group E buildings. The area of a Group E building not more than one *story above grade plane*, of Type II, IIIA or IV construction, shall not be limited provided that the following criteria are met:

1. Each classroom shall have not less than two *means of egress*, with one of the *means of egress* being a direct exit to the outside of the building complying with Section 1022.
2. The building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
3. The building is surrounded and adjoined by *public ways* or *yards* not less than 60 feet (18 288 mm) in width.

507.12 Motion picture theaters. In buildings of Type II construction, the area of a motion picture theater located on the first *story above grade plane* shall not be limited where the building is provided with an *automatic sprinkler system* throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by *public ways* or *yards* not less than 60 feet (18 288 mm) in width.

507.13 Covered and open mall buildings and anchor buildings. The area of *covered and open mall buildings* and *anchor buildings* not exceeding three *stories* in height that comply with Section 402 shall not be limited.

SECTION 508
MIXED USE AND OCCUPANCY

[S] 508.1 General. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3, 508.4 or 508.5, or a combination of these sections.

Exceptions:

1. Occupancies separated in accordance with Section 510.
2. Where required by Table 415.6.5, areas of Group H-1, H-2 and H-3 occupancies shall be located in a *detached building* or structure.
3. Offices, mercantile, food preparation establishments for off-site consumption, personal care salons or similar uses in Group R *dwelling units*, which are conducted primarily by the occupants of a *dwelling unit* and are secondary to the use of the unit for dwelling purposes, and which do not exceed 500 square feet (46.4 m^2) are not considered a separate occupancy.

[S] 508.2 Accessory occupancies. Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections 508.2.1 through 508.2.4.

508.2.1 Occupancy classification. Accessory occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space.

508.2.2 Allowable building height. The allowable height and number of *stories* of the building containing accessory occupancies shall be in accordance with Section 504 for the main occupancy of the building.

508.2.3 Allowable building area. The allowable area of the building shall be based on the applicable provisions of Section 506 for the main occupancy of the building. Aggregate accessory occupancies shall not occupy more than 10 percent of the floor area of the *story* in which they are located and shall not exceed the tabular values for nonsprinklered buildings in Table 506.2 for each such accessory occupancy.

508.2.4 Separation of accessory occupancies. No separation is required between accessory occupancies and the main occupancy.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group I-1, R-1, R-2 and R-3 *dwelling units* and *sleeping units* shall be separated from other *dwelling* or *sleeping units* and from accessory occupancies contiguous to them in accordance with the requirements of Section 420.

508.3 Nonseparated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall be considered as nonseparated occupancies.

508.3.1 Occupancy classification. Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space. In addition, the most restrictive provisions of Chapter 9 that apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area.

508.3.1.1 High-rise buildings. Where nonseparated occupancies occur in a *high-rise building*, the most restrictive requirements of Section 403 that apply to the nonseparated occupancies shall apply throughout the *high-rise building*.

508.3.1.2 Group I-2, Condition 2 occupancies. Where one of the nonseparated occupancies is Group I-2, Condition 2, the most restrictive requirements of Sections 407, 509 and 712 shall apply throughout the *fire area* containing the Group I-2 occupancy. The most restrictive requirements of Chapter 10 shall apply to the path of egress from the Group I-2, Condition 2 occupancy up to and including the *exit discharge.*

508.3.2 Allowable building area, height and number of stories. The allowable *building area, height* and number of *stories* of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.

508.3.3 Separation. No separation is required between nonseparated occupancies.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group I-1, R-1, R-2 and R-3 *dwelling units* and *sleeping units* shall be separated from other *dwelling* or *sleeping units* and from other occupancies contiguous to them in accordance with the requirements of Section 420.

[S] 508.4 Separated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall be considered as separated occupancies.

Exceptions:

1. No separation is required between Group A-2 or A-3 and Groups B or M occupancies when both are protected by an *automatic sprinkler system*.
2. Subject to the approval of the *building official*, unprotected openings are permitted in separations between parking areas and enclosed portions of buildings such as entry lobbies and similar areas provided:
   - 2.1. The floors of the enclosed *building* with unprotected openings are protected by an *automatic sprinkler system*;
   - 2.2. The openings are glazed with either tempered or laminated glazing materials;
   - 2.3. When required by the *building official*, the glazing is protected on the parking side with a sprinkler system designed to wet the entire glazed surface; and
   - 2.4. The parking areas are used primarily for passenger loading and unloading and vehicle drive-through uses.

508.4.1 Occupancy classification. Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building. The most restrictive provisions of Chapter 9 that apply to the separate occupancies shall apply to the total nonfire-barrier-separated occupancy areas. Occupancy separations that serve to define *fire area* limits established in Chapter 9 for requiring a *fire protection system* shall also comply with Section 901.7.

508.4.2 Allowable building area. In each *story*, the *building area* shall be such that the sum of the ratios of the actual *building area* of each separated occupancy divided by the allowable *building* area of each separated occupancy shall not exceed 1.

508.4.3 Allowable building height and number of stories. Each separated occupancy shall comply with the *building height limitations* and *story* limitations based on the type of construction of the building in accordance with Section 503.1.

Exception: Special provisions of Section 510 shall permit occupancies at *building heights* and number of *stories* other than provided in Section 503.1.

508.4.4 Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

508.4.4.1 Construction. Required separations shall be *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. *Mass timber* elements serving as *fire barriers* or *horizontal assemblies* to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an *approved* thermal barrier consisting of *gypsum board* that is not less than 1/2 inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

[S] TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		B[e]		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		((B[e],)) F-1, ((M,)) S-1		M		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	1	2	2	NP	1	2	N	1	1	2	1	2	NP	NP	3	4	2	3	2	NP
B[e]	—	—	N	N	1	2	2	NP	1	2	N	N	1	2	N	N	NP	NP	2	3	1	2	1	NP
I-1[a], I-3, I-4	1	2	—	—	N	N	2	NP	1	NP	1	2	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	—	—	2	NP	N	N	2	NP	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	—	—	1	NP	2	NP	N	N	1[c]	2[c]	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	—	—	1	2	2	NP	1[c]	2[c]	N	N	1	2	1	2	NP	NP	3	4	2	3	2	NP
((B[e],)) F-1, ((M,)) S-1	1	2	—	—	1	2	2	NP	1	2	1	2	N	N	N	N	NP	NP	2	3	1	2	1	NP
M	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	—	—	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	—	—	3	NP	3	NP	3	NP	3	4	2	3	—	—	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	—	—	2	NP	2	NP	2	NP	2	3	1	2	—	—	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	—	—	2	NP	2	NP	2	NP	2	NP	1	NP	—	—	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not Permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Sections 406.3.2 and 406.6.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for *ambulatory care facilities*.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

[W][S] 508.5 Live/work units. A *live/work unit* shall comply with Sections 508.5 through 508.5.11.

Exception: *Dwelling or sleeping units* that include an office that is less than 10 percent of the area of the *dwelling unit* are permitted to be classified as *dwelling units* with accessory occupancies in accordance with Section 508.2.

508.5.1 Limitations. The following shall apply to live/work areas:

1. The *live/work unit* is permitted to be not greater than 3,000 square feet (279 m^2) in area.
2. The nonresidential area is permitted to be not more than 50 percent of the area of each *live/work unit*.

((~~3. The nonresidential area function shall be limited to the first or main floor only of the *live/work unit*.~~

~~4. Not more than five nonresidential workers or employees are allowed to occupy the nonresidential area at any one time.~~))

508.5.2 Occupancies. *Live/work units* shall be classified as a Group R-2 or Group R-3 occupancy. Separation requirements found in ((~~Sections 420 and~~)) Section 508 shall not apply within the *live/work unit* where the *live/work unit* is in compliance with Sections 508.5 and 420. Nonresidential uses that would otherwise be classified as either a Group H or S occupancy shall not be permitted in a *live/work unit*.

Exception: Storage shall be permitted in the *live/work unit* provided that the aggregate area of storage in the nonresidential portion of the *live/work unit* shall be limited to 10 percent of the space dedicated to nonresidential activities.

508.5.3 Means of egress. Except as modified by this section, the *means of egress* components for a *live/work unit* shall be designed in accordance with Chapter 10 for the function served.

508.5.4 Egress capacity. The egress capacity for each element of the *live/work unit* shall be based on the *occupant load* for the function served in accordance with Table 1004.5.

508.5.5 Spiral stairways. *Spiral stairways* that conform to the requirements of Section 1011.10 shall be permitted.

508.5.6 Vertical openings. Floor openings between floor levels of a *live/work unit* are permitted without enclosure.

[F] 508.5.7 Fire protection. The *live/work unit* shall be provided with a monitored *fire alarm* system where required by Section 907.2.9. ((~~and an~~)) An *automatic sprinkler system* shall be provided in the *live/work unit* in accordance with:

1. Section ((~~903.2.8~~)) 903.3.1.2 or 903.3.1.3 for Group R occupancies in buildings with four or fewer *dwelling units* that do not exceed two *stories* in height that are less than 5,000 square feet in area; or
2. Section 903.3.1.1 for all other buildings.

508.5.8 Structural. Floors within a *live/work unit* shall be designed for the *live loads* in Table 1607.1, based on the function within the space. The nonresidential portion of the unit shall be designed for a live load of not less than 50 psf.

508.5.9 Accessibility. *Accessibility* shall be designed in accordance with Chapter 11 for the function served.

Interpretation I419.7: Accessibility provisions for Group M occupancies shall be applied unless the applicant specifies another occupancy.

508.5.10 Ventilation. The applicable *ventilation* requirements of the *International Mechanical Code* shall apply to each area within the *live/work unit* for the function within that space.

508.5.11 Plumbing facilities. The nonresidential area of the *live/work unit* shall be provided with minimum plumbing facilities as specified by Chapter 29, based on the function of the nonresidential area. Where the nonresidential area of the *live/work unit* is required to be accessible by Section 1108.6.2.1, the plumbing fixtures specified by Chapter 29 shall be accessible.

SECTION 509
INCIDENTAL USES

509.1 General Incidental uses located within single occupancy or mixed occupancy buildings shall comply with the provisions of this section. Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses specified in Table 509.1.

Exception: Incidental uses within and serving a *dwelling unit* are not required to comply with this section.

[W][S][F]TABLE 509.1
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In *ambulatory care facilities*, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour

[W][S][F]TABLE 509.1—continued
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.
Dry type transformers over 112.5 kVA and required to be in a fire-resistance-rated room in accordance with Seattle Electrical Code Section 450.21(B)[1]	1 hour or provide automatic sprinkler system
Elevator control and machine rooms	See Section 3020.4

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

1. Dry type transformers rated over 35,000 volts and oil-insulated transformers shall be installed in a transformer vault complying with Section 430 and the Seattle Electrical Code.

509.2 Occupancy classification. Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located.

Interpretation I509.2: For the purpose of this section, occupied roofs are considered floors used for human occupancy if the occupant load of the roof is ten or more on a building not equipped with an *automatic sprinkler system* or where the occupant load is 50 or more on the roof of a building that is equipped with an *automatic sprinkler system*.

[S] 509.3 Area limitations. Incidental uses shall not occupy more than 10 percent of the *building area* of the *story* in which they are located. Incidental uses that occupy more than 10 percent of the *building area* of the *story* in which they are located shall comply with either Table 509.1 or Section 508.4, whichever requires a greater separation.

509.4 Separation and protection. The incidental uses specified in Table 509.1 shall be separated from the remainder of the building or equipped with an *automatic sprinkler system*, or both, in accordance with the provisions of that table.

509.4.1 Separation. Where Table 509.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the *building* by a *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both. Construction supporting 1-hour *fire barriers* or *horizontal assemblies* used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

509.4.1.1 Type IV-B and IV-C construction. Where Table 509.1 specifies a fire-resistance-rated separation, *mass timber* elements serving as *fire barriers* or *horizontal assemblies* in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an *approved* thermal barrier consisting of *gypsum board* that is not less than 1/2 inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

509.4.2 Protection. Where Table 509.1 permits an *automatic sprinkler system* without a *fire barrier*, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The walls shall extend from the top of the foundation or floor assembly below to the underside of the ceiling that is a component of a fire-resistance-rated floor assembly or roof assembly above or to the underside of the floor or roof sheathing, deck or slab above. Doors shall be self- or automatic-closing upon detection of smoke in accordance with Section 716.2.6.6. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80. Walls surrounding the incidental use shall not have air transfer openings unless provided with *smoke dampers* in accordance with Section 710.8.

509.4.2.1 Protection limitation. Where an *automatic sprinkler system* is provided in accordance with Table 509.1, only the space occupied by the incidental use need be equipped with such a system.

SECTION 510
SPECIAL PROVISIONS

[S] 510.1 General. The provisions in Sections 510.2 through ((~~510.9~~)) 510.10 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable *building heights and areas* of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections 510.2 through ((~~510.8~~)) 510.7 are to be considered independent and separate from each other.

Interpretation I510.1: Sections 510.2 through 510.7 are not permitted to be used in combination with each other. Sections 510.8 through 510.10 are permitted to be used in combination with Section 510.2.

[W][S] 510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of *fire walls*, limitation of number of *stories* and type of construction where the following conditions are met:

1. The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 3 hours. Where ((~~vertical offsets are provided as part of~~)) a *horizontal assembly* contains vertical offsets, the vertical offset ((~~and the structure supporting the vertical offset~~)) shall be constructed as a fire barrier in accordance with Section 707 and shall have a *fire-resistance rating* of not less than 3 hours.
2. The building below, including the *horizontal assembly* and any associated vertical offsets, is of Type IA construction.
3. *Shaft*, *stairway*, *ramp* and escalator enclosures through the *horizontal assembly* shall have not less than a 2-hour *fire-resistance rating* with opening protectives in accordance with Section 716.

   Exception: Where the enclosure walls below the *horizontal assembly* have not less than a 3-hour *fire-resistance rating* with opening protectives in accordance with Section 716, the enclosure walls extending above the *horizontal assembly* shall be permitted to have a 1-hour *fire-resistance rating*, provided that the following conditions are met:

   1. The building above the *horizontal assembly* is not required to be of Type I construction.
   2. The enclosure connects fewer than four stories.
   3. The enclosure opening protectives above the *horizontal assembly* have a *fire protection rating* of not less than 1 hour.
4. *Interior exit stairways* located within the Type IA building are permitted to be of combustible materials where the following requirements are met:
   4.1. The building above the Type IA building is of Type III, IV, or V construction.
   4.2. The *stairway* located in the Type IA building is enclosed by 3-hour fire-resistance-rated construction with opening protectives in accordance with Section 716.
5. The building or buildings above the *horizontal assembly* shall be permitted to have ((~~multiple Group A occupancy uses, each with an *occupant load* of less than 300, or Group B, M, R or S occupancies.~~)) any of the following occupancies:
   5.1. One or more Group A occupancy uses, each with an occupant load of less than 300;
   5.2. Group B;
   5.3. Group I-1, Condition 2 licensed care facilities and residential treatment facilities;
   5.4. Group M;
   5.5. Group R;
   5.6. Group S-2 parking garage used for the parking and storage of private motor vehicles; and
   5.7. Uses incidental to the operation or serving occupants of the *building* (including entry lobbies, mechanical rooms, storage areas and similar uses).
6. The building below the *horizontal assembly* ((~~shall be protected throughout by an *approved automatic sprinkler system* in accordance with Section 903.3.1.1, and shall be~~)) is permitted to be any occupancy allowed by this code except Group H.
7. The maximum *building height* in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the *grade plane*.
8. All portions of the *buildings* above and below the three-hour *horizontal assembly* shall be protected throughout with an *automatic sprinkler system* that complies with Section 903.3.1.1.
9. Where the construction type above the horizontal assembly is of Type V-A, III-A or IV-HT construction, occupied floors shall be not more than 75 feet above the lowest level of fire department vehicle access.

Exception: Where the construction type above the horizontal assembly is of Type III-A construction and is using the provisions of Section 510.10.

Interpretation I510.2: For the purpose of this item, occupied roof decks are considered floors used for human occupancy if the occupant load of the deck is 10 or more on the roof of a building not equipped with an *automatic sprinkler system* or where the occupant load is 50 or more on the roof of a *building* that is equipped with an *automatic sprinkler system.*

10. Interior exit stairways serving more than 6 *stories above grade plane* shall be pressurized in accordance with Section 909.20.6 for low-rise stairways.

510.3 Group S-2 enclosed parking garage with Group S-2 open parking garage above. A Group S-2 enclosed parking garage with not more than one *story above grade plane* and located below a Group S-2 *open parking garage* shall be classified as a separate and distinct building for the purpose of determining the type of construction where the following conditions are met:

1. The allowable area of the building shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the *fire-resistance* requirements of the Group S-2 *open parking garage*.
3. The height and the number of tiers of the Group S-2 *open parking garage* shall be limited as specified in Table 406.5.4.
4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 *open parking garage* shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 *open parking garage*, except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet (93 m^2) and mechanical equipment rooms associated with the operation of the building.

[S] 510.4 Parking beneath Group R. Where a maximum one *story above grade plane* Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV-HT construction, with grade entrance, is provided under a building of Group R, the number of *stories* to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a *fire-resistance rating* not less than the mixed occupancy separation required in Section 508.4. For purposes of this section, the Group R occupancy shall * be no more than four *stories* in height.

((~~510.6~~)) 510.5 Group R-1 and R-2 buildings of Type IIA construction. The height limitation for buildings of Type IIA construction in Groups R-1 and R-2 shall be increased to nine *stories* and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the *lot* and from *lot lines*, the *exits* are segregated in an area enclosed by a 2-hour fire-resistance-rated *fire wall* and the first floor assembly has a *fire-resistance rating* of not less than 1-1/2 hours.

((~~510.7~~)) 510.6 Open parking garage beneath Groups A, I, B, M and R. *Open parking garages* constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.5. The height and area of the portion of the building above the *open parking garage* shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and *stories*, of the portion of the building above the *open parking garage* shall be measured from *grade plane* and shall include both the *open parking garage* and the portion of the building above the parking garage.

((~~510.7.1~~)) 510.6.1 Fire separation. *Fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required *fire-resistance rating* prescribed in Table 508.4 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. *Means of egress* for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by *fire barriers* having not less than a 2-hour *fire-resistance rating* as required by Section 707 with *self-closing* doors complying with Section 716 or *horizontal assemblies* having not less than a 2-hour *fire-resistance rating* as required by Section 711, with *self-closing* doors complying with Section 716. *Means of egress* from the *open parking garage* shall comply with Section 406.5.

((~~510.8~~)) 510.7 Group B or M buildings with Group S-2 open parking garage above. Group B or M occupancies located below a Group S-2 *open parking garage* of a lesser type of construction shall be considered as a separate and distinct building from the Group S-2 *open parking garage* for the purpose of determining the type of construction where the following conditions are met:

1. The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 2 hours.
2. The occupancies in the building below the *horizontal assembly* are limited to Groups B and M.
3. The occupancy above the *horizontal assembly* is limited to a Group S-2 *open parking garage*.
4. The building below the *horizontal assembly* is of Type IA construction.

   Exception: The building below the *horizontal assembly* shall be permitted to be of Type IB or II construction, but not less than the type of construction required for the Group S-2 *open parking garage* above, where the building below is not greater than *one story* in height above *grade plane.*
5. The height and area of the building below the *horizontal assembly* does not exceed the limits set forth in Section 503.
6. The height and area of the Group S-2 *open parking garage* does not exceed the limits set forth in Section 406.5. The height, in both feet and *stories*, of the Group S-2 *open parking garage* shall be measured from *grade plane* and shall include the building below the *horizontal assembly*.
7. *Exits* serving the Group S-2 *open parking garage* shall discharge at grade with direct and unobstructed access to a street or *public way* and are separated from the building below the *horizontal assembly* by 2-hour *fire barriers* constructed in accordance with Section 707 or 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

((~~510.9~~)) 510.8 Multiple buildings above a horizontal assembly. Where two or more buildings are provided above the *horizontal assembly* separating a Group S-2 parking garage or building below from the buildings above in accordance with the special provisions in Section 510.2, 510.3 or ((~~510.8~~)) 510.7, the buildings above the *horizontal assembly* shall be regarded as separate and distinct buildings from each other and shall comply with all other provisions of this code as applicable to each separate and distinct building.

[W][S] ((~~510.5~~)) 510.9 Group R-1 and R-2 buildings of Type IIIA construction. For buildings of Type IIIA construction in Groups R-1 and R-2, the maximum allowable height in Table 504.3 shall be increased ((~~by 10 feet (3048 mm) and the maximum allowable number of *stories* in Table 504.4 shall be increased~~)) by one story where the first-floor assembly above the *basement* has a *fire-resistance rating* of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated *fire walls* into areas of not more than 3,000 square feet (279 m^2). **

[S] 510.10 Group R-2 buildings of Type IIIA construction. The height limitation for *buildings* of Type IIIA construction in Group R-2 shall be increased to six *stories* where all of the following conditions are met:

1. The first story of Type IIIA construction is separated from stories above with a *horizontal assembly* having a *fire-resistance rating* of not less than 2 hours. Fire-resistance rated mass timber is permitted in the horizontal assembly and its supporting structure.
2. All stories of Type IIIA construction greater than 6,000 gross square feet shall be subdivided into compartments, by 2-hour fire-resistance rated *fire walls*, with areas of not more than 12,000 gross square feet.
3. Each compartment shall have an enclosed *exit stairway*, and a standpipe in accordance with Section 905.
4. Unprotected vertical openings, including unenclosed interior *exit access stairways*, shall not penetrate floor/ceiling assemblies between stories of Type IIIA construction or between stories of Type IIIA and Type IA construction.
5. Mezzanines shall not be allowed in any story of the Type IIIA construction.
6. The maximum total design *dead load* shall be 50 psf for all roof areas above the sixth story of Type IIIA construction.

Note: The *dead load* shall be calculated as specified in Chapter 2 and Section 1606 of this code.

Note: The maximum total design *dead load* of 50 psf is permitted to be applied over the entire roof area above the sixth story of Type IIIA construction.

CHAPTER 6

TYPES OF CONSTRUCTION

User note:

About this chapter: *Chapter 6 establishes five types of construction in which each building must be categorized. This chapter looks at the materials used in the building (combustible or noncombustible) and the extent to which building elements such as the building frame, roof, wall and floor can resist fire. Depending on the type of construction and the specific building element, fire resistance of 1 to 3 hours is specified.*

SECTION 601
GENERAL

601.1 Scope. The provisions of this chapter shall control the classification of buildings as to type of construction.

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a, b]	2[a, b, c]	1[b, c]	0[c]	1[b, c]	0	3[a]	2[a]	2[a]	HT	1[b, c]	0
Bearing walls												
Exterior[e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2[h]	2[h]	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1-1/2[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1-1/2	1	1	HT	1[b,c]	0

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of this code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).
f. Not less than the fire-resistance rating as referenced in Section 704.10.
g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.
Note: See Sections 1019, 1023 and 603.1 item 27 for stairway construction.
h. The fire-resistance rating for mezzanines constructed in accordance with Section 505.2 need not exceed 1 hour.

SECTION 602
CONSTRUCTION CLASSIFICATION

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five *construction types* defined in Sections 602.2 through 602.5. The *building elements* shall have a *fire-resistance rating* not less than that specified in Table 601 and *exterior walls* shall have a *fire-resistance rating* not less than that specified in Table 705.5. Where required to have a *fire-resistance rating* by Table 601, *building elements* shall comply with the applicable provisions of Section 703.2. The protection of openings, ducts and air transfer openings in *building elements* shall not be required unless required by other provisions of this code.

602.1.1 Minimum requirements. A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.

602.2 Types I and II. Types I and II construction are those types of construction in which the *building elements* specified in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in this code.

602.3 Type III. Type III construction is that type of construction in which the *exterior walls* are of noncombustible materials and the interior *building elements* are of any material permitted by this code. *Fire-retardant-treated wood* framing and sheathing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

Interpretation I602.3: Type IIIA buildings are permitted to include exposed heavy-timber construction for columns, beams, girders, arches, trusses, floors and roof decks except for fire-resistive construction required by Sections 510 and 713 and Chapter 10. Heavy timber is permitted in concealed spaces in Type IIIA buildings where provided with protection per Section 602.4.4.3.

602.4 Type IV. Type IV construction is that type of construction in which the *building elements* are *mass timber* or noncombustible materials and have *fire-resistance ratings* in accordance with Table 601. *Mass timber* elements shall meet the *fire-resistance-rating* requirements of this section based on either the *fire-resistance rating* of the *noncombustible protection*, the *mass timber*, or a combination of both and shall be determined in accordance with Section 703.2. The minimum dimensions and permitted materials for *building elements* shall comply with the provisions of this section and Section 2304.11. *Mass timber* elements of Types IV-A, IV-B and IV-C construction shall be protected with *noncombustible protection* applied directly to the *mass timber* in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the *noncombustible protection* shall be determined in accordance with Section 703.6 and comply with Section 722.7.

Cross-laminated timber shall be labeled as conforming to ANSI/APA PRG 320 as referenced in Section 2303.1.4.

Exterior *load-bearing walls* and *nonload-bearing walls* shall be *mass timber* construction, or shall be of noncombustible construction.

Exception: Exterior load-bearing walls and nonload-bearing walls of Type IV-HT Construction in accordance with Section 602.4.4.

The interior *building elements,* including *nonload-bearing walls* and partitions, shall be of *mass timber* construction or of noncombustible construction.

Exception: Interior building elements and nonload-bearing walls and partitions of Type IV-HT construction in accordance with Section 602.4.4.

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light frame walls of Type IV-HT construction shall not be considered concealed spaces, but shall comply with Section 718.

In buildings of Type IV-A, IV-B, and IV-C construction with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department access, up to and including 12 *stories* or 180 feet (54 864 mm) above *grade plane*, *mass timber* interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 *stories* or 180 feet (54 864 mm) above *grade plane*, interior exit and elevator hoistway enclosures shall be constructed of noncombustible materials.

602.4.1 Type IV-A. *Building elements* in Type IV-A construction shall be protected in accordance with Sections 602.4.1.1 through 602.4.1.6. The required *fire-resistance rating* of noncombustible elements and protected *mass timber* elements shall be determined in accordance with Section 703.2.

602.4.1.1 Exterior protection. The outside face of *exterior walls* of *mass timber* construction shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Components of the *exterior wall covering* shall be of noncombustible material except *water-resistive barriers* having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a *flame spread index* of 25 or less and a *smoke-developed index* of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.1.2 Interior protection. Interior faces of all *mass timber* elements, including the inside faces of exterior *mass timber* walls and *mass timber* roofs, shall be protected with materials complying with Section 703.3.

602.4.1.2.1 Protection time. *Noncombustible protection* shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

602.4.1.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the *mass timber*. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.1.4 Roofs. The *interior surfaces* of *roof assemblies* shall be protected in accordance with Section 602.4.1.2. *Roof coverings* in accordance with Chapter 15 shall be permitted on the outside surface of the *roof assembly.*

602.4.1.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *International Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.1.6 Shafts. *Shafts* shall be permitted in accordance with Sections 713 and 718. Both the *shaft* side and room side of *mass timber* elements shall be protected in accordance with Section 602.4.1.2.

602.4.2 Type IV-B. *Building elements* in Type IV-B construction shall be protected in accordance with Sections 602.4.2.1 through 602.4.2.6. The required *fire-resistance rating* of noncombustible elements or *mass timber* elements shall be determined in accordance with Section 703.2.

602.4.2.1 Exterior protection. The outside face of *exterior walls* of *mass timber* construction shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Components of the *exterior wall covering* shall be of noncombustible material except *water-resistive barriers* having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354, and having a *flame spread index* of 25 or less and a *smoke-developed index* of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.2.2 Interior protection. Interior faces of all *mass timber* elements, including the inside face of exterior *mass timber* walls and *mass timber* roofs, shall be protected, as required by this section, with materials complying with Section 707.3.

602.4.2.2.1 Protection time. *Noncombustible protection* shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

[W] 602.4.2.2.2 Protected area. Interior faces of *mass timber* elements, including the inside face of exterior *mass timber walls* and *mass timber roofs*, shall be protected in accordance with Section 602.4.2.2.1.

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls complying with one of the following:
   1.1. Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area <u>less than or</u> equal to ((~~20~~)) <u>100</u> percent of the floor area in any dwelling unit or fire area.
   1.2. Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area <u>less than or</u> equal to 40 percent of the floor area in any dwelling unit or fire area.
   1.3. Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with Section 602.4.2.2.3.
2. Mass timber columns and beams that are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.

602.4.2.2.3 Mixed unprotected areas. In each *dwelling unit* or *fire area*, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.

$$(Utc/Uac) + (Utw/Uaw) \leq 1 \qquad \textbf{(Equation 6-1)}$$

where:

Utc = Total unprotected mass timber ceiling areas.

Uac = Allowable unprotected mass timber ceiling area conforming to Exception 1.1 of Section 602.4.2.2.2.

Utw = Total unprotected mass timber wall areas.

Uaw = Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2.

[W] 602.4.2.2.4 Separation distance between unprotected mass timber elements. In each *dwelling unit* or *fire area*, unprotected portions of *mass timber* walls and ceilings shall be not less than 15 feet (4572 mm) from unprotected portions of other walls ((~~and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls~~)) measured horizontally along the floor.

[W] 602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the *mass timber*. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. ((~~The~~)) Except where unprotected mass timber ceilings are permitted in Section 602.4.2.2.2, the underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.2.4 Roofs. The *interior surfaces* of roof assemblies shall be protected in accordance with Section 602.4.2.2 except, in nonoccupiable spaces, they shall be treated as a concealed space with no portion left unprotected. *Roof coverings* in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.2.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *International Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.2.6 Shafts. *Shafts* shall be permitted in accordance with Sections 713 and 718. Both the *shaft* side and room side of *mass timber* elements shall be protected in accordance with Section 602.4.1.2.

602.4.3 Type IV-C. *Building elements* in Type IV-C construction shall be protected in accordance with Sections 602.4.3.1 through 602.4.3.6. The required *fire-resistance rating* of *building elements* shall be determined in accordance with Section 703.2.

602.4.3.1 Exterior protection. The exterior side of walls of combustible construction shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes, as determined in Table 722.7.1(1). Components of the *exterior wall covering* shall be of noncombustible material except *water-resistive barriers* having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354 and having a *flame spread index* of 25 or less and a *smoke-developed index* of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.3.2 Interior protection. *Mass timber* elements are permitted to be unprotected.

602.4.3.3 Floors. Floor finishes in accordance with Section 804 shall be permitted on top of the floor construction.

602.4.3.4 Roof coverings. *Roof coverings* in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.3.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *International Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1).

602.4.3.6 Shafts. *Shafts* shall be permitted in accordance with Sections 713 and 718. *Shafts* and elevator hoistway and *interior exit stairway enclosures* shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1), on both the inside of the *shaft* and the outside of the *shaft.*

602.4.4 Type IV-HT. Type IV-HT (Heavy Timber) construction is that type of construction in which the *exterior walls* are of noncombustible materials and the interior *building elements* are of solid wood, laminated heavy timber or *structural composite lumber* (SCL), without concealed spaces or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, SCL and *cross-laminated timber* (*CLT*) and the details of Type IV construction shall comply with the provisions of this section and Section 2304.11. *Exterior walls* complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rated or heavy timber conforming with Section 2304.11.2.2 shall be permitted.

602.4.4.1 Fire-retardant-treated wood in exterior walls. *Fire-retardant-treated wood* framing and sheathing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies with a 2-hour rating or less.

602.4.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber* (*CLT*) not less than 4 inches (102 mm) in thickness complying with Section 2303.1.4 shall be permitted within *exterior wall* assemblies with a 2-hour rating or less. Heavy timber structural members appurtenant to the *CLT exterior wall* shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the *exterior wall*. The exterior surface of the cross-laminated timber and heavy timber elements shall be protected by one the following:

1. *Fire-retardant-treated wood* sheathing complying with Section 2303.2 and not less than 15/32 inch (12 mm) thick.
2. *Gypsum board* not less than 1/2 inch (12.7 mm) thick.
3. A noncombustible material.

[W] 602.4.4.3 Concealed spaces. Concealed spaces shall not contain combustible materials other than *building elements* and electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *International Mechanical Code*. Concealed spaces shall comply with applicable provisions of Section 718. Concealed spaces shall be protected in accordance with one or more of the following:

1. The building shall be sprinklered throughout in accordance with Section 903.3.1.1 and automatic sprinklers shall also be provided in the concealed space.
2. The concealed space shall be completely filled with noncombustible insulation.
3. ((~~Surfaces~~)) Combustible surfaces within the concealed space shall be fully sheathed with not less than 5/8-inch Type X gypsum board.

Exception: Concealed spaces within interior walls and partitions with a 1-hour or greater fire-resistance rating complying with Section 2304.11.2.2 shall not require additional protection.

602.4.4.4 Exterior structural members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes complying with Section 2304.11 shall be permitted to be used externally.

602.5 Type V. Type V construction is that type of construction in which the structural elements, *exterior walls* and interior walls are of any materials permitted by this code.

Interpretation I602.5: Type VA buildings are permitted to include exposed heavy-timber construction for columns, beams, girders, arches, trusses, floors and roof decks except for fire-resistive construction required by Sections 510 and 713 and Chapter 10. Heavy timber is permitted in concealed spaces in Type VA buildings where provided with protection per Section 602.4.4.3.

SECTION 603
COMBUSTIBLE MATERIAL IN TYPES I AND II CONSTRUCTION

[S] 603.1 Allowable materials. Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. *Fire-retardant-treated wood* shall be permitted in:
   - 1.1. Nonbearing partitions where the required *fire-resistance rating* is 2 hours or less except in *shaft enclosures* within Group I-2 occupancies and *ambulatory care facilities.*
   - 1.2. Nonbearing *exterior walls* where fire-resistance-rated construction is not required.
   - 1.3. Roof construction, including girders, trusses, framing and decking.

     Exceptions:

     1. In buildings of Type IA construction exceeding two *stories above grade plane*, *fire-retardant-treated wood* is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).
     2. Group I-2, roof construction containing *fire-retardant-treated wood* shall be covered by not less than a Class A *roof covering* or roof assembly, and the roof assembly shall have a *fire-resistance rating* where required by the construction type.
   - 1.4. Balconies, porches, decks and exterior *stairways* not used as required exits on buildings three *stories* or less above grade plane.
2. Thermal and acoustical insulation, other than foam plastics, having a *flame spread index* of not more than 25.

   Exceptions:

   1. Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a *flame spread index* of not more than 100.
   2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a *flame spread index* of not more than 200.
3. Foam plastics in accordance with Chapter 26.
4. *Roof coverings* that have an A, B or C classification.
5. *Interior floor finish* and floor covering materials installed in accordance with Section 804.
6. Millwork such as doors, door frames, window sashes and frames.
7. *Interior wall and ceiling finishes* installed in accordance with Section 803.
8. *Trim* installed in accordance with Section 806.

9. Where not installed greater than 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
10. Finish flooring installed in accordance with Section 805.
11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a *corridor* serving an *occupant load* of 30 or more shall be permitted to be constructed of *fire-retardant-treated* wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.
12. *Stages* and *platforms* constructed in accordance with Sections 410.2 and 410.3, respectively.
13. Combustible *exterior wall coverings*, balconies and similar projections and bay or oriel windows in accordance with Chapter 14 and Section 705.2.3.1.
14. Blocking such as for handrails, millwork, cabinets and window and door frames.
15. Light-transmitting plastics as permitted by Chapter 26.
16. Mastics and caulking materials applied to provide flexible seals between components of *exterior wall* construction.
17. Exterior plastic *veneer* installed in accordance with Section 2605.2.
18. Nailing or furring strips as permitted by Section 803.15.
19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.4.4 and 705.2.3.1.
20. Aggregates, component materials and admixtures as permitted by Section 703.2.1.2.
21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of *fire resistance* tests in accordance with Section 703.2 and installed in accordance with Sections 1705.15 and 1705.16, respectively.
22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
23. Materials used to protect *joints* in fire-resistance-rated assemblies in accordance with Section 715.
24. Materials allowed in the concealed spaces of buildings of Types I and II construction in accordance with Section 718.5.
25. Materials exposed within plenums complying with Section 602 of the *International Mechanical Code*.
26. Wall construction of freezers and coolers of less than 1,000 square feet (92.9 m^2), in size, lined on both sides with noncombustible materials and the building is protected throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
27. Wood nailers for parapet flashing and roof cants.
28. Stairways within individual *dwelling units* and stairways serving a single tenant space are permitted to be of fire-retardant-treated wood or heavy-timber construction. In other than Group R occupancies, such stairways shall not serve as a required means of egress.
29. Stairways complying with Section 510.2, item 4.
30. Aluminum is permitted as follows:
    - 30.1. Where combustible materials, including fire retardant treated wood, are allowed by the code;
    - 30.2. For structural members supporting less than 500 square feet that do not have direct connections to columns and bracing members designed to carry gravity loads;
    - 30.3. In curtain walls *approved* or listed for use in non-combustible construction; and
    - 30.4. Unprotected aluminum frames for *awnings* in accordance with Section 3105.5.

603.1.1 Ducts. The use of nonmetallic ducts shall be permitted where installed in accordance with the limitations of the *International Mechanical Code*.

603.1.2 Piping. The use of combustible piping materials shall be permitted where installed in accordance with the limitations of the *International Mechanical Code* and the ((~~*International*~~)) *Uniform Plumbing Code*.

603.1.3 Electrical. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted where installed in accordance with the limitations of this code.

CHAPTER 7

FIRE AND SMOKE PROTECTION FEATURES

User note:

About this chapter: *Chapter 7 provides detailed requirements for fire-resistance-rated construction, including structural members, walls, partitions and horizontal assemblies. Other portions of the code describe where certain fire-resistance-rated elements are required. This chapter specifies how these elements are constructed, how openings in walls and partitions are protected and how penetrations of such elements are protected.*

SECTION 701
GENERAL

[S] 701.1 Scope. The provisions of this chapter shall govern the materials, systems and assemblies used for structural *fire resistance* and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

Exceptions:

1. Carports are not required to comply with this chapter if they satisfy all the following criteria:
   1.1. Accessory to Group R-3 occupancies.
   1.2. Used to shelter only vehicles, trailers or vessels.
   1.3. Constructed of metal, plastic or fabric.
   1.4. No more than 3 pounds per square foot in total weight.
   1.5. No more than 300 square feet covered area.
2. Temporary tents and similar structures are not required to comply with this chapter if they satisfy all the following criteria:
   2.1. The occupant load is less than 100;
   2.2. The structure is fully or partially enclosed and 400 square feet or less in area; or is entirely unenclosed and 700 square feet or less in area;
   2.3. The structure is constructed of metal, plastic or fabric; and
   2.4. The structure is no more than 3 pounds per square foot in total weight.

SECTION 702
MULTIPLE-USE FIRE ASSEMBLIES

702.1 Multiple-use fire assemblies. Fire assemblies that serve multiple purposes in a building shall comply with all of the requirements that are applicable for each of the individual fire assemblies.

SECTION 703
FIRE-RESISTANCE RATINGS AND FIRE TESTS

703.1 Scope. Materials prescribed herein for *fire resistance* shall conform to the requirements of this chapter.

703.2 Fire resistance. The *fire-resistance rating* of *building elements*, components or assemblies shall be determined in accordance with Section 703.2.1 or 703.2.2 without the use of *automatic* sprinklers or any other fire suppression system being incorporated, or in accordance with Section 703.2.3.

703.2.1 Tested assemblies. A *fire-resistance rating* of *building elements*, components or assemblies shall be determined by the test procedures set forth in ASTM E119 or UL 263. The *fire-resistance rating* of penetrations and *fire-resistant joint systems* shall be determined in accordance with Sections 714 and 715, respectively.

703.2.1.1 Nonsymmetrical wall construction. Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned *fire-resistance rating* shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E119 or UL 263. Where evidence is furnished to show

that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the *building official*, the wall need not be subjected to tests from the opposite side (see Section 705.5 for *exterior walls*).

703.2.1.2 Combustible components. Combustible aggregates are permitted in gypsum and Portland cement concrete mixtures for fire-resistance-rated construction. Any component material or admixture is permitted in assemblies if the resulting tested assembly meets the *fire-resistance* test requirements of this code.

703.2.1.3 Restrained classification. Fire-resistance-rated assemblies tested under ASTM E119 or UL 263 shall not be considered to be restrained unless evidence satisfactory to the *building official* is furnished by the *registered design professional* showing that the construction qualifies for a restrained classification in accordance with ASTM E119 or UL 263. Restrained construction shall be identified on the *construction documents*.

703.2.1.4 Supplemental features. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the *building element,* component or assembly, sufficient data shall be made available to the *building official* to show that the required *fire-resistance rating* is not reduced.

703.2.1.5 Exterior bearing walls. In determining the *fire-resistance rating* of exterior bearing walls, compliance with the ASTM E119 or UL 263 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required *fire-resistance rating* of an exterior nonbearing wall with the same *fire separation distance*, and in a building of the same group. Where the *fire-resistance rating* determined in accordance with this exception exceeds the *fire-resistance rating* determined in accordance with ASTM E119 or UL 263, the fire exposure time period, water pressure and application duration criteria for the hose stream test of ASTM E119 or UL 263 shall be based on the *fire-resistance rating* determined in accordance with this section.

703.2.2 Analytical methods. The fire resistance of *building elements*, components or assemblies established by an analytical method shall be by any of the methods listed in this section, based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263.

1. *Fire-resistance* designs documented in approved sources.
2. Prescriptive designs of fire-resistance-rated *building elements*, components or assemblies as prescribed in Section 721.
3. Calculations in accordance with Section 722.
4. Engineering analysis based on a comparison of *building element,* component or assemblies designs having *fire-resistance ratings* as determined by the test procedures set forth in ASTM E119 or UL 263.
5. *Fire-resistance* designs certified by an *approved* agency.

[S] 703.2.3 Approved alternate method. The *fire resistance* of *building elements*, components or assemblies not complying with Section 703.2.1 or 703.2.2 shall be permitted to be established by an alternative protection method in accordance with Section ((~~104.11~~)) 104.5.

703.3 Noncombustibility tests. The tests indicated in Section 703.3.1 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Types I, II, III and IV construction. The term "noncombustible" does not apply to the *flame spread* characteristics of *interior finish* or *trim* materials. A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or *flame spread* beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.

703.3.1 Noncombustible materials. Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.

Exception: Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch (3.18 mm) in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

703.4 Fire-resistance-rated glazing. Fire-resistance-rated glazing, when tested in accordance with ASTM E119 or UL 263 and complying with the requirements of Section 707, shall be permitted. Fire-resistance-rated glazing shall bear a *label* marked in accordance with Table 716.1(1) issued by an agency and shall be permanently identified on the glazing.

[S] 703.5 Marking and identification. Where there is an accessible concealed floor, floor-ceiling or *attic* space, *fire walls*, *fire barriers*, *fire partitions*, *smoke barriers* and *smoke partitions* or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space. Such identification shall:

1. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition.

2. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8-inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording, "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS," or other similar wording.

703.6 Determination of noncombustible protection time contribution. The time, in minutes, contributed to the *fire-resistance rating* by the *noncombustible protection* of *mass timber building elements*, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL 263. The test assemblies shall be identical in construction, loading and materials, other than the *noncombustible protection*. The two test assemblies shall be tested to the same criteria of structural failure with the following conditions:

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The *noncombustible protection* time contribution shall be determined by subtracting the *fire-resistance* time, in minutes, of Test Assembly 1 from the *fire-resistance* time, in minutes, of Test Assembly 2.

703.7 Sealing of adjacent mass timber elements. In buildings of Types IV-A, IV-B and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

SECTION 704
FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

704.1 Requirements. The *fire-resistance ratings* of structural members and assemblies shall comply with this section and the requirements for the type of construction as specified in Table 601. The *fire-resistance ratings* shall be not less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.

Exception: *Fire barriers*, *fire partitions*, *smoke barriers* and *horizontal assemblies* as provided in Sections 707.5, 708.4, 709.4 and 711.2, respectively.

704.2 Column protection. Where columns are required to have protection to achieve a *fire-resistance rating*, the entire column shall be provided individual encasement protection by protecting it on all sides for the full column height, including connections to other structural members, with materials having the required *fire-resistance rating*. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

Exception: Columns that meet the limitations of Section 704.4.1.

704.3 Protection of the primary structural frame other than columns. Members of the *primary structural frame* other than columns that are required to have protection to achieve a *fire-resistance rating* and support more than two floors or one floor and roof, or support a *load-bearing wall* or a *nonload-bearing wall* more than two *stories* high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required *fire-resistance rating*.

Exception: Individual encasement protection on all sides shall be permitted on all exposed sides provided that the extent of protection is in accordance with the required *fire-resistance rating*, as determined in Section 703.

704.4 Protection of secondary structural members. *Secondary structural members* that are required to have protection to achieve a *fire-resistance rating* shall be protected by individual encasement protection.

704.4.1 Light-frame construction. Studs, columns and boundary elements that are integral elements in *walls* of *light-frame construction* and are located entirely between the top and bottom plates or tracks shall be permitted to have required *fire-resistance ratings* provided by the membrane protection provided for the *wall*.

[S] 704.4.2 Horizontal assemblies. ((~~*Horizontal*~~)) *Secondary members* within horizontal *assemblies* are permitted to be protected with a membrane or ceiling where the membrane or ceiling provides the required *fire-resistance rating* and is installed in accordance with Section 711.

704.5 Truss protection. The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on *approved* calculations based on such tests that satisfactorily demonstrate that the assembly has the required *fire resistance*.

704.6 Attachments to structural members. The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within 1 inch (25 mm) of the surface of the fire protection.

[W] 704.6.1 Secondary (nonstructural) attachments to structural members. Where primary and secondary structural steel members require fire protection, ((~~secondary steel attachments to those structural members shall be protected with the same fire-resistive material and thickness as required for the structural member~~)) any additional structural steel members having direct connection to the primary structural frame or secondary structural members shall be protected with the same fire-resistive material and thickness as required for the structural member. The protection shall extend away from the structural member a distance of not less than 12 inches (305 mm), or shall be applied to the entire length where the attachment is less than 12 inches (305 mm) long. Where an attachment is hollow and the ends are open, the fire-resistive material and thickness shall be applied to both exterior and interior of the hollow steel attachment.

704.7 Reinforcing. Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5 inch (12.7 mm) into the protection.

704.8 Embedments and enclosures. Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

704.9 Impact protection. Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than 5 feet (1524 mm) from the finished floor.

Exception: Corner protection is not required on concrete columns in parking garages.

704.10 Exterior structural members. Load-bearing structural members located within the *exterior walls* or on the outside of a building or structure shall be provided with the highest *fire-resistance rating* as determined in accordance with the following:

1. As required by Table 601 for the type of *building element* based on the type of construction of the building.
2. As required by Table 601 for exterior bearing walls based on the type of construction.
3. As required by Table 705.5 for *exterior walls* based on the *fire separation distance*.

704.11 Bottom flange protection. Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet 4 inches (1931 mm) whether part of the *primary structural frame* or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

704.12 Seismic isolation systems. *Fire-resistance ratings* for the isolation system shall meet the *fire-resistance rating* required for the columns, walls or other structural elements in which the isolation system is installed in accordance with Table 601. Isolation systems required to have a *fire-resistance rating* shall be protected with *approved* materials or construction assemblies designed to provide the same degree of *fire resistance* as the structural element in which the system is installed when tested in accordance with ASTM E119 or UL 263 (see Section 703.2).

Such isolation system protection applied to isolator units shall be capable of retarding the transfer of heat to the isolator unit in such a manner that the required gravity load-carrying capacity of the isolator unit will not be impaired after exposure to the standard time-temperature curve fire test prescribed in ASTM E119 or UL 263 for a duration not less than that required for the *fire-resistance rating* of the structure element in which the system is installed.

Such isolation system protection applied to isolator units shall be suitably designed and securely installed so as not to dislodge, loosen, sustain damage or otherwise impair its ability to accommodate the seismic movements for which the isolator unit is designed and to maintain its integrity for the purpose of providing the required fire-resistance protection.

704.13 Sprayed fire-resistant materials (SFRM). Sprayed fire-resistant materials (SFRM) shall comply with Sections 704.13.1 through 704.13.5.

704.13.1 Fire-resistance rating. The application of SFRM shall be consistent with the *fire-resistance rating* and the listing, including, but not limited to, minimum thickness and dry density of the applied SFRM, method of application, substrate surface conditions and the use of bonding adhesives, sealants, reinforcing or other materials.

704.13.2 Manufacturer's installation instructions. The application of SFRM shall be in accordance with the manufacturer's installation instructions. The instructions shall include, but are not limited to, substrate temperatures and surface conditions and SFRM handling, storage, mixing, conveyance, method of application, curing and *ventilation*.

704.13.3 Substrate condition. The SFRM shall be applied to a substrate in compliance with Sections 704.13.3.1 and 704.13.3.2.

704.13.3.1 Surface conditions. Substrates to receive SFRM shall be free of dirt, oil, grease, release agents, loose scale and any other condition that prevents adhesion. The substrates shall be free of primers, paints and encapsulants other

than those fire tested and *listed* by a nationally recognized testing agency. Primed, painted or encapsulated steel shall be allowed, provided that testing has demonstrated that required adhesion is maintained.

704.13.3.2 Primers, paints and encapsulants. Where the SFRM is to be applied over primers, paints or encapsulants other than those specified in the listing, the material shall be field tested in accordance with ASTM E736. Where testing of the SFRM with primers, paints or encapsulants demonstrates that required adhesion is maintained, SFRM shall be permitted to be applied to primed, painted or encapsulated wide flange steel shapes in accordance with the following conditions:

1. The beam flange width does not exceed 12 inches (305 mm); or
2. The column flange width does not exceed 16 inches (400 mm); or
3. The beam or column web depth does not exceed 16 inches (400 mm).
4. The average and minimum bond strength values shall be determined based on not fewer than five bond tests conducted in accordance with ASTM E736. Bond tests conducted in accordance with ASTM E736 shall indicate an average bond strength of not less than 80 percent and an individual bond strength of not less than 50 percent, when compared to the bond strength of the SFRM as applied to clean, uncoated 1/8-inch-thick (3.2 mm) steel plate.

704.13.4 Temperature. A minimum ambient and substrate temperature of 40°F (4.44°C) shall be maintained during and for not fewer than 24 hours after the application of the SFRM, unless the manufacturer's instructions allow otherwise.

704.13.5 Finished condition. The finished condition of SFRM applied to structural members or assemblies shall not, upon complete drying or curing, exhibit cracks, voids, spalls, delamination or any exposure of the substrate. Surface irregularities of SFRM shall be deemed acceptable.

SECTION 705
EXTERIOR WALLS AND PROJECTIONS

705.1 General. *Exterior walls* shall comply with this section.

[S] 705.2 Projections. *Cornices*, eave overhangs, exterior balconies and similar projections extending beyond the ((~~*exterior wall*~~)) *building area* shall conform to the requirements of this section and Section 1405. Exterior egress balconies and exterior *exit stairways* and *ramps* shall comply with Sections 1021 and 1027, respectively. Projections shall not extend any closer to the line used to determine the *fire separation distance* than shown in Table 705.2.

Exception: Buildings on the same lot and considered as portions of one building in accordance with Section 705.3 are not required to comply with this section for projections between the buildings.

TABLE 705.2
MINIMUM DISTANCE OF PROJECTION

FIRE SEPARATION DISTANCE (FSD) (feet)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 to less than 2	Projections not permitted
2 to less than 3	24 inches
3 to less than 5	Two-thirds of FSD
5 or greater	40 inches

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.

Code Alternate CA705.2: Private balconies and decks constructed with grated metal decking that allows smoke and heat to ventilate are permitted to be considered projections and not floor area. Noncombustible exterior structure supporting only the grated balcony or deck is not required to be fire-resistance rated. Exterior exposed noncombustible columns supporting the grated decks are not required to be fire-resistance rated.

Interpretation I705.2: For purposes of Section 705.2, gutters 6 inches or less in width that are not an integral part of the structure are not considered projections on Group R-3 occupancies and on Group U accessory occupancies.

705.2.1 Types I and II construction. Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials as allowed by Sections 705.2.3.1 and 705.2.4.

705.2.2 Type III, IV or V construction. Projections from walls of Type III, IV or V construction shall be of any *approved* material.

Eave overhangs from walls of Types IIIA, IV or VA construction or from walls that are otherwise required to be of *fire-resistance-rated* construction shall be finished on the underside with at least 1/2-inch (13 mm) gypsum sheathing or equiv-

alent or shall be heavy timber construction conforming to Section 2304.11. Vents are permitted to be installed if the vent openings are covered with corrosion–resistant metal mesh.

See Section 714.5.2 for allowable vent penetrations.

705.2.3 Projection protection. Projections extending to within 5 feet (1524 mm) of the line used to determine the *fire separation distance* shall be one of the following:

1. Noncombustible materials.
2. Combustible materials of not less than 1-hour fire-resistance-rated construction.
3. Heavy timber construction complying with Section 2304.11.
4. Fire-retardant-treated wood.
5. As permitted by Section 705.2.3.1.

Exceptions:

1. Type VB construction shall be allowed for combustible projections in Group R-3 and U occupancies with a *fire separation distance* greater than or equal to 5 feet (1524 mm).
2. Eave overhangs are permitted to be of less than one-hour construction provided the underside is finished with at least 1/2-inch (13 mm) gypsum sheathing or equivalent.

[S] 705.2.3.1 Balconies and similar projections. Balconies and similar projections of combustible construction other than *fire-retardant-treated wood* shall be *fire-resistance* rated where required by Table 601 for floor construction or shall be of heavy timber construction in accordance with Section 2304.11. The aggregate length of the projections shall not exceed 50 percent of the building's perimeter on each floor.

Exceptions:

1. On buildings of Types I and II construction, three *stories* or less above *grade plane*, *fire-retardant-treated wood* shall be permitted for balconies, porches, decks and exterior *stairways* not used as required exits.
2. Untreated wood and plastic composites that comply with ASTM D7032 and Section 2612 are permitted for pickets, rails and similar *guard* components that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar projections on buildings of Types III, IV and V construction shall be permitted to be of Type V construction and shall not be required to have a *fire-resistance rating* where sprinkler protection is extended to these areas.
4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

705.2.4 Bay and oriel windows. Bay and oriel windows constructed of combustible materials shall conform to the type of construction required for the building to which they are attached.

Exception: *Fire-retardant-treated wood* shall be permitted on buildings three *stories* or less above *grade plane* of Type I, II, III or IV construction.

[S] 705.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection, projections and *roof-covering* requirements, buildings on the same lot shall be assumed to have an imaginary line between them.

Where a new building is to be erected on the same lot as an *existing building*, the location of the assumed imaginary line with relation to the existing building shall be such that the *exterior wall* and opening protection of the *existing building* meet the criteria as set forth in Sections 705.5 and 705.8.

Exceptions:

1. Two or more buildings on the same lot shall be either regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.
2. Where an S-2 parking garage of Construction Type I or IIA is erected on the same lot as a Group R-2 building, and ((~~there is no *fire separation distance* between these buildings~~)) where openings are not permitted or are required by this code to be protected, then the adjoining *exterior walls* between the buildings are permitted to have occupant use openings in accordance with Section 706.8. However, opening protectives in such openings shall only be required in the *exterior wall* of the S-2 parking garage, not in the *exterior wall* openings in the R-2 building, and these opening protectives in the *exterior wall* of the S-2 parking garage shall be not less than 1-1/2-hour *fire protection rating*.

705.4 Materials. *Exterior walls* shall be of materials permitted by the building's type of construction.

705.5 Fire-resistance ratings. *Exterior walls* shall be *fire-resistance* rated in accordance with Table 601, based on the type of construction, and Table 705.5, based on the *fire separation distance*. The required *fire-resistance rating* of *exterior walls* with a

fire separation distance of greater than 10 feet (3048 mm) shall be rated for exposure to fire from the inside. The required *fire-resistance rating* of *exterior walls* with a *fire separation distance* of less than or equal to 10 feet (3048 mm) shall be rated for exposure to fire from both sides.

[W][S] TABLE 705.5
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, d, g, j]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[i], S-2, U[h]
X < 5[b]	All	3	2	1
5 ≤ X < 10	IA, IVA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IVA, IVB	2	1	1[c]
	IIB, VB	1	0	0
	Others	1	1	1[c]
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
b. See Section 706.1.1 for party walls.
c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
e. For special requirements for Group H occupancies, see Section 415.6.
f. For special requirements for Group S aircraft hangars, see Section 412.3.1.
g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.
i. For a Group R-3 building of Type II-B or Type V-B construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.
j. In a mixed occupancy building containing Group R-3 and Group U private garage, the exterior wall fire-resistance rating shall be as required for Group R-3.
k. *Existing buildings* may encroach a maximum of 4 inches into the required *fire separation distance*, solely for the purpose of adding insulation to the building exterior.

705.6 Structural stability. *Exterior walls* shall extend to the height required by Section 705.11. Interior structural elements that brace the *exterior wall* but that are not located within the plane of the *exterior wall* shall have the minimum *fire-resistance rating* required in Table 601 for that structural element. Structural elements that brace the *exterior wall* but are located outside of the *exterior wall* or within the plane of the *exterior wall* shall have the minimum *fire-resistance rating* required in Table 601 and Table 705.5 for the *exterior wall.*

705.7 Unexposed surface temperature. Where protected openings are not limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of *exterior walls* as required by ASTM E119 or UL 263 shall not apply. Where protected openings are limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of *exterior walls* as required by ASTM E119 or UL 263 shall not apply provided that a correction is made for radiation from the unexposed *exterior wall* surface in accordance with the following formula:

$$A_e = A + (A_f \times F_{eo}) \qquad \textbf{(Equation 7-1)}$$

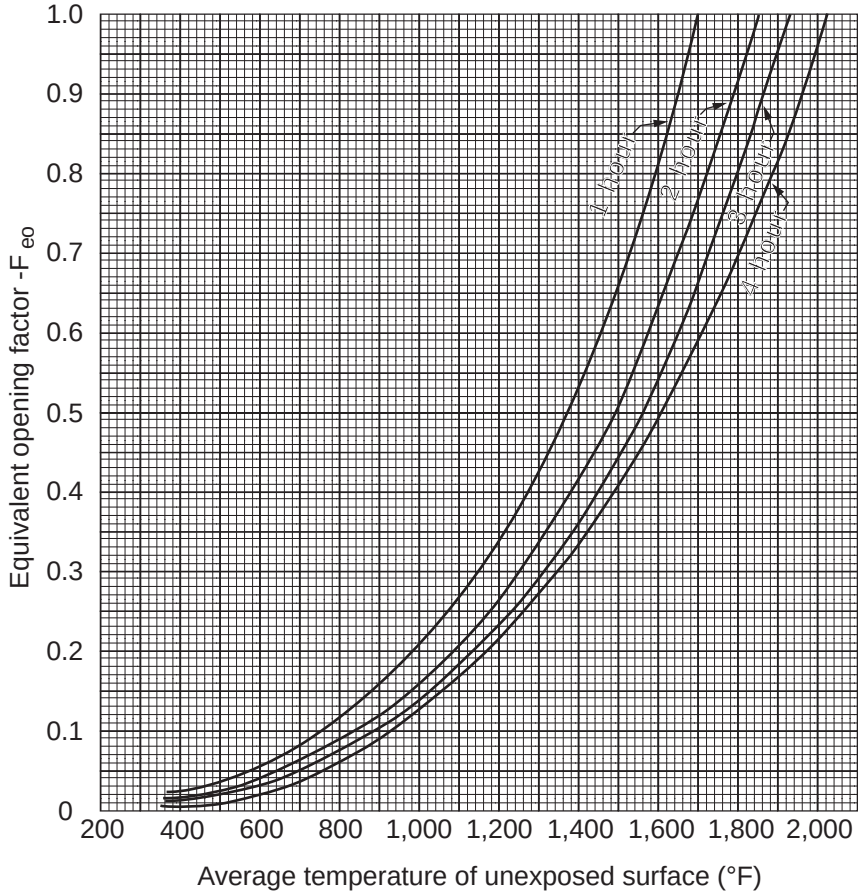
where:

A_e = Equivalent area of protected openings.

A = Actual area of protected openings.

A_f = Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E119 or UL 263 for walls are exceeded.

F_{eo} = An "equivalent opening factor" derived from Figure 705.7 based on the average temperature of the unexposed wall surface and the fire-resistance rating of the wall.



For SI: °C = [(°F) - 32] / 1.8.

FIGURE 705.7
EQUIVALENT OPENING FACTOR

[S] 705.8 Openings. Openings in *exterior walls* shall comply with Sections 705.8.1 through 705.8.6. For spaces that are not provided with *exterior walls*, the vertical plane at the edge of the horizontal projection of the roof or floor is considered an exterior wall.

Interpretation I705.8: For purposes of Section 705.8, where the *fire separation distance* on a lower floor is greater than the *fire separation distance* on the floor above creating an overhang, there are two options for wall, soffit, and opening protection. The fire-resistance rating of the soffit shall be no less than required rating for floor construction by Table 601.

Option 1: The plane that projects vertically from the edge of the *story*, roof or deck above shall comply with the exterior wall and opening protection requirements. The portion of the plane where the wall is recessed is considered an opening. The fire-resistance rating of the soffit shall be no less than required rating for the recessed exterior wall.

Option 2: Recessed *exterior walls* shall comply with the wall fire rating and wall opening protection percentages as if the *fire separation distance* is equal to the *story*, roof or deck above. The soffit shall be fire-resistance rated not less than as required for the recessed exterior wall. The use of the recessed area underneath the protected overhang is restricted to egress or circulation.

See Figures I705.8a and I705.8b.

Interpretation I705.8:
Option 1. Exterior wall protection extends from A to B to C.
Option 2. Exterior wall protection extends from A to B to B1 to C1. Fire-resistance rating and opening protection for wall B-B1-C1, and fire-resistance rating at soffit B-B1-C1-C comply with requirements for wall B-C. The length of the wall segment B-B1 shall be included when calculating the percentage of openings allowed.

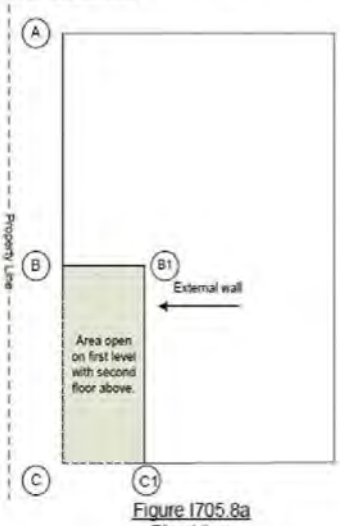


Figure I705.8a
Plan View

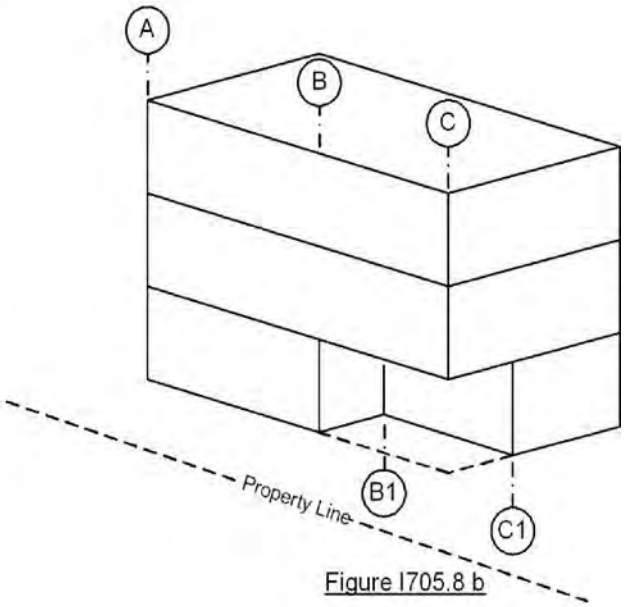


Figure I705.8 b

Note: Opening protection in wall C to C1 isn't considered in Figures I705.8a and I705.8b because it is perpendicular to the property line.

[S] 705.8.1 Allowable area of openings. The maximum area of unprotected and protected openings permitted in an *exterior wall* in any *story* of a building shall not exceed the percentages specified in Table 705.8 based on the *fire separation distance* of each individual story.

Exceptions:

1. In other than Group H occupancies, unlimited unprotected openings are permitted in the first *story above grade plane* where the wall faces one of the following:
   1.1. A street and has a *fire separation distance* of more than ((~~15 feet (4572 mm)~~)) 30 feet (9144 mm).
   1.2. An unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall be not less than 30 feet (9144 mm) in width and shall have access from a street by a posted fire lane in accordance with the *International Fire Code*.
2. Buildings whose exterior bearing walls, exterior nonbearing walls and exterior *primary structural frame* are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

[W][S] TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION[l]

FIRE SEPARATION DISTANCE (feet)[l]	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA[a]
0 to less than 3[b, c, k]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted[k]
	Unprotected, Sprinklered (UP, S)[i]	Not Permitted[k]
	Protected (P)	Not Permitted[k]
3 to less than 5[d, e]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S)[i]	15%
	Protected (P)	15%
5 to less than 10[e, f, j]	Unprotected, Nonsprinklered (UP, NS)	10%[h]
	Unprotected, Sprinklered (UP, S)[i]	25%
	Protected (P)	25%
10 to less than 15[e, f, g, j]	Unprotected, Nonsprinklered (UP, NS)	15%[h]
	Unprotected, Sprinklered (UP, S)[i]	45%
	Protected (P)	45%
15 to less than 20[f, g, j]	Unprotected, Nonsprinklered (UP, NS)	25%
	Unprotected, Sprinklered (UP, S)[i]	75%
	Protected (P)	75%
20 to less than 25[f, g, j]	Unprotected, Nonsprinklered (UP, NS)	45%
	Unprotected, Sprinklered (UP, S)[i]	No Limit
	Protected (P)	No Limit
25 to less than 30[f, g, j]	Unprotected, Nonsprinklered (UP, NS)	70%
	Unprotected, Sprinklered (UP, S)[i]	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (UP, NS)	No Limit
	Unprotected, Sprinklered (UP, S)[i]	No Limit
	Protected (P)	No Limit

For SI: 1 foot = 304.8 mm.

UP, NS = Unprotected openings in buildings not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

UP, S = Unprotected openings in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

P = Openings protected with an opening protective assembly in accordance with Section 705.8.2.

a. Values indicated are the percentage of the area of the exterior wall, per story.
b. For the requirements for fire walls of buildings with differing heights, see Section 706.6.1.
c. For openings in a fire wall for buildings on the same lot, see Section 706.8.
d. The maximum percentage of unprotected and protected openings shall be 25 percent for Group R-3 occupancies.
e. Unprotected openings shall not be permitted for openings with a fire separation distance of less than 15 feet for Group H-2 and H-3 occupancies.
f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies, with a fire separation distance of 5 feet or greater.
g. The area of openings in an open parking structure with a fire separation distance of 10 feet or greater shall not be limited.
h. Includes buildings accessory to Group R-3.
i. Not applicable to Group H-1, H-2 and H-3 occupancies.
j. The area of openings in a building containing only a Group U occupancy private garage or carport with a fire separation distance of 5 feet or greater shall not be limited.
k. For openings between S-2 parking garage and Group R-2 building, see Section 705.3, Exception 2.
l. In a mixed occupancy building containing Group R-3 and Group U private garage, the maximum area of exterior openings shall be as required for Group R-3.
m. For the purpose of calculating the maximum area of *exterior wall* openings on *existing buildings*, the *fire separation distances* indicated in the chart may be reduced by a maximum of 4 inches, solely for the purpose of adding insulation to the building exterior.

705.8.2 Protected openings. Where openings are required to be protected, opening protectives shall comply with Section 716.

Exception: Opening protectives are not required where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 and the exterior openings are protected by a water curtain using automatic sprinklers *approved* for that use.

4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.

4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.

4.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire-resistance-rated *exterior wall* for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.

4.4. The entire building shall be provided with not less than a Class B *roof covering*.

5. In Groups R-2 and R-3 where the entire building is provided with a Class C *roof covering*, the *exterior wall* shall be permitted to terminate at the underside of the roof sheathing or deck in Types III, IV and V construction, provided that one or both of the following criteria is met:

5.1. The roof sheathing or deck is constructed of *approved* noncombustible materials or of *fire-retardant-treated wood* for a distance of 4 feet (1220 mm).

5.2. The roof is protected with 0.625-inch (16 mm) Type X *gypsum board* directly beneath the underside of the roof sheathing or deck, supported by not less than nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm).

6. Where the wall is permitted to have not less than 25 percent of the *exterior wall* areas containing unprotected openings based on *fire separation distance* as determined in accordance with Section 705.8.

705.11.1 Parapet construction. Parapets shall have the same *fire-resistance rating* as that required for the supporting wall, and on any side adjacent to a roof surface, shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials. The height of the parapet shall be not less than 30 inches (762 mm) above the point where the roof surface and the wall intersect. Where the roof slopes toward a parapet at a slope greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a *fire separation distance* where protection of wall openings is required, but the height shall be not less than 30 inches (762 mm).

SECTION 706
FIRE WALLS

706.1 General. *Fire walls* shall be constructed in accordance with Sections 706.2 through 706.11. The extent and location of such *fire walls* shall provide a complete separation. Where a *fire wall* separates occupancies that are required to be separated by a *fire barrier* wall, the most restrictive requirements of each separation shall apply.

706.1.1 Party walls. Any wall located on a *lot line* between adjacent buildings, which is used or adapted for *joint* service between the two buildings, shall be constructed as a *fire wall* in accordance with Section 706. Party walls shall be constructed without openings and shall create separate buildings.

Exceptions:

1. Openings in a party wall separating an *anchor building* and a *mall* shall be in accordance with Section 402.4.2.2.1.
2. Party walls and *fire walls* are not required on *lot lines* dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the *lot line* do not exceed the maximum height and area requirements of this code. For the *building official's* review and approval, the official shall be provided with copies of dedicated access easements and contractual agreements that permit the *owners* of portions of the building located on either side of the *lot line* access to the other side for purposes of maintaining fire and *life safety systems* necessary for the operation of the building.

[S] ((~~706.2 Structural stability.~~ ~~*Fire walls* shall be designed and constructed to allow collapse of the structure on either side without collapse of the wall under fire conditions. *Fire walls* designed and constructed in accordance with NFPA 221 shall be deemed to comply with this section.~~

~~**Exception:** In *Seismic Design Categories* D through F, where double *fire walls* are used in accordance with NFPA 221, floor and roof sheathing not exceeding 3/4 inch (19.05 mm) thickness shall be permitted to be continuous through the wall assemblies of *light frame construction*.~~))

[W] 706.3 Materials. *Fire walls* that separate a building of Type I or II construction from a building of any construction type shall be of any *approved* noncombustible materials. Other *fire walls* shall be built of materials consistent with the types permitted for the type of construction of the building.

((~~Exception:~~ ~~Buildings of Type V construction.~~))

706.4 Fire-resistance rating. *Fire walls* shall have a *fire-resistance rating* of not less than that required by Table 706.4.

[W] TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3[a]
F-1, H-3b, H-5, M, S-1	3
H-1, H-2	4[b]
F-2, S-2, R-3, R-4	2

a. In Type II, III, IV or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.
b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.

706.5 Horizontal continuity. *Fire walls* shall be continuous from *exterior wall* to *exterior wall* and shall extend not less than 18 inches (457 mm) beyond the exterior surface of *exterior walls*.

Exceptions:

1. *Fire walls* shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided that the *exterior wall* has a *fire-resistance rating* of not less than 1 hour for a horizontal distance of not less than 4 feet (1220 mm) on both sides of the *fire wall*. Openings within such *exterior walls* shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.
2. *Fire walls* shall be permitted to terminate at the interior surface of noncombustible exterior sheathing, exterior siding or other noncombustible exterior finishes provided that the sheathing, siding or other exterior noncombustible finish extends a horizontal distance of not less than 4 feet (1220 mm) on both sides of the *fire wall*.
3. *Fire walls* shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the *fire wall* is protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.

706.5.1 Exterior walls. Where the *fire wall* intersects *exterior walls*, the *fire-resistance rating* and opening protection of the *exterior walls* shall comply with one of the following:

1. The *exterior walls* on both sides of the *fire wall* shall have a 1-hour *fire-resistance rating* with 3/4-hour protection where opening protection is required by Section 705.8. The *fire-resistance rating* of the *exterior wall* shall extend not less than 4 feet (1220 mm) on each side of the intersection of the *fire wall* to *exterior wall*. *Exterior wall* intersections at *fire walls* that form an angle equal to or greater than 180 degrees (3.14 rad) do not need *exterior wall* protection.
2. Buildings or spaces on both sides of the intersecting *fire wall* shall assume to have an imaginary *lot line* at the *fire wall* and extending beyond the exterior of the *fire wall*. The location of the assumed line in relation to the *exterior walls* and the *fire wall* shall be such that the *exterior wall* and opening protection meet the requirements set forth in Sections 705.5 and 705.8. Such protection is not required for *exterior walls* terminating at *fire walls* that form an angle equal to or greater than 180 degrees (3.14 rad).

706.5.2 Horizontal projecting elements. *Fire walls* shall extend to the outer edge of horizontal projecting elements such as balconies, roof overhangs, canopies, *marquees* and similar projections that are within 4 feet (1220 mm) of the *fire wall*.

Exceptions:

1. Horizontal projecting elements without concealed spaces, provided that the *exterior wall* behind and below the projecting element has not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting element on both sides of the *fire wall*. Openings within such *exterior walls* shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.
2. Noncombustible horizontal projecting elements with concealed spaces, provided that a minimum 1-hour fire-resistance-rated wall extends through the concealed space. The projecting element shall be separated from the building by not less than 1-hour fire-resistance-rated construction for a distance on each side of the *fire wall* equal to the depth of the projecting element. The wall is not required to extend under the projecting element where the building *exterior wall* is not less than 1-hour *fire-resistance rated* for a distance on each side of the *fire wall* equal to the depth of the projecting element. Openings within such *exterior walls* shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.

3. For combustible horizontal projecting elements with concealed spaces, the *fire wall* need only extend through the concealed space to the outer edges of the projecting elements. The *exterior wall* behind and below the projecting element shall be of not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting elements on both sides of the *fire wall*. Openings within such *exterior walls* shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.

[S] 706.6 Vertical continuity. *Fire walls* shall extend from the foundation to a termination point not less than 30 inches (762 mm) above both adjacent roofs.

Exceptions:

1. Stepped buildings in accordance with Section 706.6.1.
2. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab, provided that:
   2.1. The ((~~lower~~)) *roof assembly* within 4 feet (1220 mm) of the wall has not less than a 1-hour *fire-resistance rating* and the entire length and span of supporting elements for the rated *roof assembly* has a *fire-resistance rating* of not less than 1 hour.
   2.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the *fire wall*.
   2.3. Each building shall be provided with not less than a Class B *roof covering*.
3. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck or slabs where both buildings are provided with not less than a Class B *roof covering*. Openings in the roof shall not be located within 4 feet (1220 mm) of the *fire wall*.
4. In buildings of Types III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks, provided that all of the following requirements are met:
   4.1. Roof openings are not less than 4 feet (1220 mm) from the *fire wall*.
   4.2. The roof is covered with a minimum Class B *roof covering.*
   4.3. The roof sheathing or deck is constructed of *fire-retardant-treated wood* for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with 5/8-inch (15.9 mm) Type X *gypsum board* directly beneath the underside of the roof sheathing or deck, supported by not less than 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a distance of not less than 4 feet (1220 mm) on both sides of the *fire wall*.
5. In buildings designed in accordance with Section 510.2, *fire walls* located above the 3-hour *horizontal assembly* required by Section 510.2, Item 1 shall be permitted to extend from the top of this *horizontal assembly*.
6. Buildings with sloped roofs in accordance with Section 706.6.2.

706.6.1 Stepped buildings. Where a *fire wall* also serves as an *exterior wall* for a building and separates buildings having different roof levels, such wall shall terminate at a point not less than 30 inches (762 mm) above the lower roof level. *Exterior walls* above the *fire wall* extending more than 30 inches (762 mm) above the lower roof shall be of not less than 1-hour fire-resistance-rated construction from both sides with openings protected by fire assemblies having a *fire protection rating* of not less than 3/4 hour. Portions of the *exterior walls* greater than 15 feet (4572 mm) above the lower roof shall be of nonfire-resistance-rated construction unless otherwise rated construction is required by other provisions of this code.

Exception: A *fire wall* serving as part of an *exterior wall* that separates buildings having different roof levels shall be permitted to terminate at the underside of the roof sheathing, deck or slab of the lower roof, provided that Items 1, 2 and 3 are met. The *exterior wall* above the *fire wall* is not required to be of fire-resistance-rated construction unless required by other provisions of this code.

1. The lower *roof assembly* within 10 feet (3048 mm) of the *fire wall* has not less than a 1-hour *fire-resistance rating*.
2. The entire length and span of supporting elements for the rated *roof assembly* shall have a *fire-resistance rating* of not less than 1 hour.
3. Openings in the lower roof shall not be located within 10 feet (3048 mm) of the *fire wall*.

[S] 706.6.2 Buildings with sloped roofs. Where a *fire wall* <u>also</u> serves as an interior wall for a building, and the roof on one side or both sides of the *fire wall* slopes toward the *fire wall* at a slope greater than 2 units vertical in 12 units horizontal (2:12), the *fire wall* shall extend to a height equal to the height of the roof located 4 feet (1219 mm) from the *fire wall* plus 30 inches (762 mm). The extension of the *fire wall* shall be not less than 30 inches (762 mm).

<u>Exceptions:</u>

<u>1. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab, provided:</u>

1.1. The *roof assembly* within 4 feet (1220 mm) of the wall has not less than a 1-hour *fire-resistance rating* and the entire length and span of supporting elements for the rated *roof assembly* has a *fire-resistance rating* of not less than 1 hour.

1.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the *fire wall.*

1.3. Each *building* shall be provided with not less than a Class B roof covering.

2. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck or slabs where both *buildings* are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 feet (1220 mm) of the *fire wall.*

3. In buildings of Type III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks, provided:

3.1. There are no openings in the roof within 4 feet (1220 mm) of the *fire wall*,

3.2. The roof is covered with a minimum Class B roof covering, and

3.3. The roof sheathing or deck is constructed of *fire-retardant-treated wood* for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with 5/8-inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm) on both sides of the *fire wall.*

706.7 Combustible framing in fire walls. Adjacent combustible members entering into a concrete or masonry *fire wall* from opposite sides shall not have less than a 4-inch (102 mm) distance between embedded ends. Where combustible members frame into hollow walls or walls of hollow units, hollow spaces shall be solidly filled for the full thickness of the wall and for a distance not less than 4 inches (102 mm) above, below and between the structural members, with noncombustible materials *approved* for *fireblocking*.

706.8 Openings. Each opening through a *fire wall* shall be protected in accordance with Section 716 and shall not exceed 156 square feet (15 m^2). The aggregate width of openings at any floor level shall not exceed 25 percent of the length of the wall.

Exceptions:

1. Openings are not permitted in party walls constructed in accordance with Section 706.1.1.
2. Openings shall not be limited to 156 square feet (15 m^2) where both buildings are equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.

706.9 Penetrations. Penetrations of *fire walls* shall comply with Section 714.

706.10 Joints. *Joints* made in or between *fire walls* shall comply with Section 715.

706.11 Ducts and air transfer openings. Ducts and air transfer openings shall not penetrate *fire walls*.

Exception: Penetrations by ducts and air transfer openings of *fire walls* that are not on a *lot line* shall be allowed provided that the penetrations comply with Section 717. The size and aggregate width of all openings shall not exceed the limitations of Section 706.8.

SECTION 707
FIRE BARRIERS

707.1 General. *Fire barriers* installed as required elsewhere in this code or the *International Fire Code* shall comply with this section.

707.2 Materials. *Fire barriers* shall be of materials permitted by the building type of construction.

707.3 Fire-resistance rating. The *fire-resistance rating* of *fire barriers* shall comply with this section.

707.3.1 Shaft enclosures. The *fire-resistance rating* of the *fire barrier* separating building areas from a *shaft* shall comply with Section 713.4.

707.3.2 Interior exit stairway and ramp construction. The *fire-resistance rating* of the *fire barrier* separating building areas from an *interior exit stairway* or *ramp* shall comply with Section 1023.1.

707.3.3 Enclosures for exit access stairways. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit access stairway* or *ramp* shall comply with Section 713.4.

707.3.4 Exit passageway. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit passageway* shall comply with Section 1024.3.

707.3.5 Horizontal exit. The *fire-resistance rating* of the separation between building areas connected by a *horizontal exit* shall comply with Section 1026.1.

707.3.6 Atriums. The *fire-resistance rating* of the *fire barrier* separating *atriums* shall comply with Section 404.6.

707.3.7 Incidental uses. The *fire barrier* separating incidental uses from other spaces in the building shall have a *fire-resistance rating* of not less than that indicated in Table 509.1.

707.3.8 Control areas. *Fire barriers* separating *control areas* shall have a *fire-resistance rating* of not less than that required in Section 414.2.4.

707.3.9 Separated occupancies. Where the provisions of Section 508.4 are applicable, the *fire barrier* separating mixed occupancies shall have a *fire-resistance rating* of not less than that indicated in Table 508.4 based on the occupancies being separated.

707.3.10 Fire areas. The *fire barriers*, *fire walls, horizontal assemblies* or combinations thereof separating a single occupancy into different *fire areas* shall have a *fire-resistance rating* of not less than that indicated in Table 707.3.10. The *fire barriers*, *fire walls, horizontal assemblies* or combinations thereof separating *fire areas* of mixed occupancies shall have a *fire-resistance rating* of not less than the highest value indicated in Table 707.3.10 for the occupancies under consideration.

TABLE 707.3.10
FIRE-RESISTANCE-RATING REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

[S] 707.3.11 Horizontal separation offsets. The fire-resistance rating of a fire barrier serving as the vertical offset in a horizontal building separation shall comply with Section 510.2.

[S] 707.3.12 Energy storage systems. The fire barrier separating energy storage systems from other spaces in the building shall have a minimum 2-hour fire-resistance rating.

707.4 Exterior walls. Where *exterior walls* serve as a part of a required fire-resistance-rated *shaft,* or separation or enclosure for a *stairway, ramp* or *exit passageway*, such walls shall comply with the requirements of Section 705 for *exterior walls* and the fire-resistance-rated enclosure or separation requirements shall not apply.

Exceptions:

1. *Exterior walls* required to be *fire-resistance rated* in accordance with Section 1021 for exterior egress balconies, Section 1023.7 for *interior exit stairways and ramps,* Section 1024.8 for *exit passageways* and Section 1027.6 for *exterior exit stairways and ramps*.
2. *Exterior walls* required to be *fire-resistance rated* in accordance with Section 1207 of the *International Fire Code* for enclosure of energy storage systems.

707.5 Continuity. *Fire barriers* shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such *fire barriers* shall be continuous through concealed space, such as the space above a suspended ceiling. *Joints* and voids at intersections shall comply with Sections 707.8 and 707.9

Exceptions:

1. *Shaft enclosures* shall be permitted to terminate at a top enclosure complying with Section 713.12.
2. *Interior exit stairway* and *ramp* enclosures required by Section 1023 and *exit access stairway* and *ramp* enclosures required by Section 1019 shall be permitted to terminate at a top enclosure complying with Section 713.12.
3. An *exit passageway* enclosure required by Section 1024.3 that does not extend to the underside of the roof sheathing, slab or deck above shall be enclosed at the top with construction of the same *fire-resistance rating* as required for the *exit passageway*.

707.5.1 Supporting construction. The supporting construction for a *fire barrier* shall be protected to afford the required *fire-resistance rating* of the *fire barrier* supported. Hollow vertical spaces within a *fire barrier* shall be fireblocked in accordance with Section 718.2 at every floor level.

Exceptions:

1. The maximum required *fire-resistance rating* for assemblies supporting *fire barriers* separating tank storage as provided for in Section 415.9.1.2 shall be 2 hours, but not less than required by Table 601 for the building construction type.
2. Supporting construction for 1-hour *fire barriers* required by Table 509.1 in buildings of Types IIB, IIIB and VB construction is not required to be *fire-resistance rated* unless required by other sections of this code.

707.6 Openings. Openings in a *fire barrier* shall be protected in accordance with Section 716. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet (15 m^2). Openings in enclosures for *exit access stairways* and *ramps*, *interior exit stairways* and *ramps* and *exit passageways* shall also comply with Sections 1019, 1023.4 and 1024.5, respectively.

Exceptions:

1. Openings shall not be limited to 156 square feet (15 m^2) where adjoining floor areas are equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
2. Openings shall not be limited to 156 square feet (15 m^2) or an aggregate width of 25 percent of the length of the wall where the opening protective is a *fire door* serving enclosures for *exit access stairways* and *ramps,* and *interior exit stairways* and *ramps*.
3. Openings shall not be limited to 156 square feet (15 m^2) or an aggregate width of 25 percent of the length of the wall where the opening protective has been tested in accordance with ASTM E119 or UL 263 and has a minimum *fire-resistance rating* not less than the *fire-resistance rating* of the wall.
4. *Fire window assemblies* permitted in *atrium* separation walls shall not be limited to a maximum aggregate width of 25 percent of the length of the wall.
5. Openings shall not be limited to 156 square feet (15 m^2) or an aggregate width of 25 percent of the length of the wall where the opening protective is a *fire door assembly* in a *fire barrier* separating an enclosure for *exit access stairways* and *ramps*, and *interior exit stairways* and *ramps* from an *exit passageway* in accordance with Section 1023.3.1.

707.7 Penetrations. Penetrations of *fire barriers* shall comply with Section 714.

707.7.1 Prohibited penetrations. Penetrations into enclosures for *exit access stairways* and *ramps*, *interior exit stairways* and *ramps*, and *exit passageways* shall be allowed only where permitted by Sections 1019, 1023.5 and 1024.6, respectively.

707.8 Joints. *Joints* made in or between *fire barriers*, and *joints* made at the intersection of *fire barriers* with underside of a fire-resistance-rated floor or roof sheathing, slab or deck above, and the exterior vertical wall intersection shall comply with Section 715.

707.9 Voids at intersections. The voids created at the intersection of a *fire barrier* and a nonfire-resistance-rated *roof assembly* or a nonfire-resistance-rated *exterior wall* assembly shall be filled. An *approved* material or system shall be used to fill the void, and shall be securely installed in or on the intersection for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to retard the passage of fire and hot gases.

707.10 Ducts and air transfer openings. Penetrations in a *fire barrier* by ducts and air transfer openings shall comply with Section 717.

SECTION 708
FIRE PARTITIONS

[S] 708.1 General. The following wall assemblies shall comply with this section:

1. Separation walls as required by Section 420.2 for Group I-1 and Group R occupancies.
2. Walls separating tenant spaces in *covered and open mall buildings* as required by Section 402.4.2.1.
3. *Corridor* walls as required by Section 1020.3.
4. Enclosed elevator lobby separation as required by Section ((~~3006.3~~)) 713.14.
5. Egress balconies as required by Section 1021.2.
6. Walls separating *ambulatory care facilities* from adjacent spaces, *corridors* or tenant as required by Section 422.2.
7. Walls separating *dwelling and sleeping units* in Groups R-1 and R-2 in accordance with Sections 907.2.8.1 and 907.2.9.1.
8. Vestibules in accordance with Section 1028.2, exception 2.
9. Elevator machine rooms and elevator control rooms as required by Section 3020.4 and Table 509.1.

708.2 Materials. The walls shall be of materials permitted by the building type of construction.

708.3 Fire-resistance rating. *Fire partitions* shall have a *fire-resistance rating* of not less than 1 hour.

Exceptions:

1. *Corridor* walls permitted to have a 1/2-hour *fire-resistance rating* by Table 1020.2.
2. *Dwelling unit* and *sleeping unit* separations in buildings of Types IIB, IIIB and VB construction shall have *fire-resistance ratings* of not less than 1/2 hour in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

708.4 Continuity. *Fire partitions* shall extend from the top of the foundation or floor/ceiling assembly below and be securely attached to one of the following:

1. The underside of the floor or roof sheathing, deck or slab above.
2. The underside of a floor/ceiling or roof/ceiling assembly having a *fire-resistance rating* that is not less than the *fire-resistance rating* of the *fire partition*.

Exceptions:

1. *Fire partitions* shall not be required to extend into a crawl space below where the floor above the crawl space has a minimum 1-hour *fire-resistance rating*.
2. *Fire partitions* serving as a *corridor* wall shall not be required to extend above the lower membrane of a *corridor* ceiling provided that the *corridor* ceiling membrane is equivalent to *corridor* wall membrane, and either of the following conditions is met:
   2.1. The room-side membrane of the *corridor* wall extends to the underside of the floor or roof sheathing, deck or slab of a fire-resistance-rated floor or roof above.
   2.2. The building is equipped with an *automatic sprinkler system* installed throughout in accordance with Section 903.3.1.1 or 903.3.1.2, including *automatic* sprinklers installed in the space between the top of the *fire partition* and underside of the floor or roof sheathing, deck or slab above.
3. *Fire partitions* serving as a *corridor* wall shall be permitted to terminate at the upper membrane of the *corridor* ceiling assembly where the *corridor* ceiling is constructed as required for the *corridor* wall.
4. *Fire partitions* separating tenant spaces in a *covered or open mall building* complying with Section 402.4.2.1 shall not be required to extend above the underside of a ceiling. Such ceiling shall not be required to be part of a fire-resistance-rated assembly, and the *attic* or space above the ceiling at tenant separation walls shall not be required to be subdivided by *fire partitions*.

[S] 708.4.1 Supporting construction. The supporting construction for a *fire partition* shall have a *fire-resistance rating* that is equal to or greater than the required *fire-resistance rating* of the supported *fire partition*.

Exception: In buildings of Types IIB, IIIB and VB construction, the supporting construction requirement shall not apply to *fire partitions* separating tenant spaces in *covered and open mall buildings, fire partitions* separating *dwelling units*, *fire partitions* separating *sleeping units*, *fire partitions* serving as *corridor* walls, *fire partitions* separating *ambulatory care facilities* from adjacent spaces or *corridors, fire partitions* separating *dwelling and sleeping units* from Group R-1 and R-2 occupancies, ((~~and~~)) *fire partitions* separating vestibules from the *level of exit discharge* and walls enclosing elevator machine rooms and elevator control rooms.

708.4.2 Fireblocks and draftstops in combustible construction. In combustible construction where *fire partitions* do not extend to the underside of the floor or roof sheathing, deck or slab above, the space above and along the line of the *fire partition* shall be provided with one of the following:

1. *Fireblocking* up to the underside of the floor or roof sheathing, deck or slab above using materials complying with Section 718.2.1.
2. Draftstopping up to the underside of the floor or roof sheathing, deck or slab above using materials complying with Section 718.3.1 for floors or Section 718.4.1 for *attics*.

Exceptions:

1. Buildings equipped with an *automatic sprinkler system* installed throughout in accordance with Section 903.3.1.1, or in accordance with Section 903.3.1.2 provided that protection is provided in the space between the top of the *fire partition* and underside of the floor or roof sheathing, deck or slab above as required for systems complying with Section 903.3.1.1.
2. Where *corridor* walls provide a *sleeping unit* or *dwelling unit* separation, draftstopping shall only be required above one of the *corridor* walls.
3. In Group R-2 occupancies with fewer than four *dwelling units*, *fireblocking* and draftstopping shall not be required.

4. In Group R-2 occupancies up to and including four *stories* in height in buildings not exceeding 60 feet (18 288 mm) in height above *grade plane*, the *attic* space shall be subdivided by *draftstops* into areas not exceeding 3,000 square feet (279 m^2) or above every two *dwelling units*, whichever is smaller.
5. In Group R-3 occupancies with fewer than three *dwelling units*, *fireblocking* and draftstopping shall not be required in floor assemblies.

708.5 Exterior walls. Where *exterior walls* serve as a part of a required fire-resistance-rated separation, such walls shall comply with the requirements of Section 705 for *exterior walls*, and the fire-resistance-rated separation requirements shall not apply.

Exception: *Exterior walls* required to be fire-resistance rated in accordance with Section 1021.2 for exterior egress balconies, Section 1023.7 for *interior exit stairways* and *ramps* and Section 1027.6 for exterior *exit stairways* and *ramps.*

708.6 Openings. Openings in a *fire partition* shall be protected in accordance with Section 716.

708.7 Penetrations. Penetrations of *fire partitions* shall comply with Section 714.

708.8 Joints. *Joints* made in or between *fire partitions* shall comply with Section 715.

708.9 Ducts and air transfer openings. Penetrations in a *fire partition* by ducts and air transfer openings shall comply with Section 717.

SECTION 709
SMOKE BARRIERS

709.1 General. Vertical and horizontal *smoke barriers* shall comply with this section.

709.2 Materials. *Smoke barriers* shall be of materials permitted by the building type of construction.

709.3 Fire-resistance rating. A 1-hour *fire-resistance rating* is required for *smoke barriers*.

Exception: *Smoke barriers* constructed of minimum 0.10-inch-thick (2.5 mm) steel in Group I-3 buildings.

[S] 709.4 Continuity. *Smoke barriers* shall form an effective membrane continuous from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required *fire-resistance rating* of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction. *Smoke-barrier* walls used to separate *smoke compartments* shall comply with Section 709.4.1. *Smoke-barrier* walls used to enclose *areas of refuge* in accordance with Section 1009.6.4 or to enclose elevator lobbies in accordance with Section 403.6.1.5, 403.6.2.6 or 405.4.3 ((~~, 3007.6.2, or 3008.6.2~~)) shall comply with Section 709.4.2.

Exception: *Smoke-barrier* walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings or *exterior walls* that provide resistance to the passage of fire and smoke equivalent to that provided by the *smoke-barrier* walls.

709.4.1 Smoke-barrier assemblies separating smoke compartments. *Smoke-barrier* assemblies used to separate *smoke compartments* shall form an effective membrane enclosure that is continuous from an outside wall or *smoke barrier* wall to an outside wall or another *smoke barrier* wall and to the *horizontal assemblies*.

[S] 709.4.2 Smoke-barrier walls enclosing areas of refuge or elevator lobbies. *Smoke-barrier* walls used to enclose *areas of refuge* in accordance with Section 1009.6.4, or to enclose elevator lobbies in accordance with Section 403.6.1.5, 403.6.2.6 or 405.4.3 ((~~, 3007.6.2, or 3008.6.2,~~)) shall form an effective membrane enclosure that terminates at a *fire barrier* wall having a level of *fire protection rating* not less than 1 hour, another *smoke barrier* wall or an outside wall. A smoke and draft control door assembly as specified in Section 716.2.2.1.1 shall not be required at each elevator hoistway door opening or at each exit doorway between an *area of refuge* and the exit enclosure.

709.5 Openings. Openings in a *smoke barrier* shall be protected in accordance with Section 716.

Exceptions:

1. In Group I-1, Condition 2, Group I-2 and *ambulatory care facilities*, where a pair of opposite-swinging doors are installed across a corridor in accordance with Section 709.5.1, the doors shall not be required to be protected in accordance with Section 716. The doors shall be close fitting within operational tolerances, and shall not have a center mullion or undercuts in excess of 3/4 inch (19.1 mm), louvers or grilles. The doors shall have head and jamb stops, and astragals or rabbets at meeting edges. Where permitted by the door manufacturer's listing, positive-latching devices are not required. Factory-applied or field-applied protective plates are not required to be labeled.
2. In Group I-1, Condition 2, Group I-2 and *ambulatory care facilities*, special purpose horizontal sliding, accordion or folding doors installed in accordance with Section 1010.3.3 and protected in accordance with Section 716.

SECTION 711
FLOOR AND ROOF ASSEMBLIES

711.1 General. *Horizontal assemblies* shall comply with Section 711.2. Nonfire-resistance-rated floor and *roof assemblies* shall comply with Section 711.3.

711.2 Horizontal assemblies. *Horizontal assemblies* shall comply with Sections 711.2.1 through 711.2.6.

711.2.1 Materials. Assemblies shall be of materials permitted by the building type of construction.

711.2.2 Continuity. Assemblies shall be continuous without vertical openings, except as permitted by this section and Section 712.

711.2.3 Supporting construction. The supporting construction shall be protected to afford the required *fire-resistance rating* of the *horizontal assembly* supported.

Exception: In buildings of Type IIB, IIIB or VB construction, the construction supporting the *horizontal assembly* is not required to be fire-resistance rated at the following:

1. *Horizontal assemblies* at the separations of incidental uses as specified by Table 509.1 provided that the required *fire-resistance rating* does not exceed 1 hour.
2. *Horizontal assemblies* at the separations of *dwelling units* and *sleeping units* as required by Section 420.3.
3. *Horizontal assemblies* at *smoke barriers* constructed in accordance with Section 709.

711.2.4 Fire-resistance rating. The *fire-resistance rating* of *horizontal assemblies* shall comply with Sections 711.2.4.1 through 711.2.4.6 but shall be not less than that required by the building type of construction.

711.2.4.1 Separating mixed occupancies. Where the *horizontal assembly* separates mixed occupancies, the assembly shall have a *fire-resistance rating* of not less than that required by Section 508.4 based on the occupancies being separated.

711.2.4.2 Separating fire areas. Where the *horizontal assembly* separates a single occupancy into different *fire areas*, the assembly shall have a *fire-resistance rating* of not less than that required by Section 707.3.10.

711.2.4.3 Dwelling units and sleeping units. *Horizontal assemblies* serving as *dwelling or sleeping unit* separations in accordance with Section 420.3 shall be not less than 1-hour *fire-resistance-rated* construction.

Exception: *Horizontal assemblies* separating *dwelling units* and *sleeping units* shall be not less than 1/2-hour fire-resistance-rated construction in a building of Types IIB, IIIB and VB construction, where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

711.2.4.4 Separating smoke compartments. Where the *horizontal assembly* is required to be a *smoke barrier*, the assembly shall comply with Section 709.

711.2.4.5 Separating incidental uses. Where the *horizontal assembly* separates incidental uses from the remainder of the building, the assembly shall have a *fire-resistance rating* of not less than that required by Section 509.

711.2.4.6 Other separations. Where a *horizontal assembly* is required by other sections of this code, the assembly shall have a *fire-resistance rating* of not less than that required by that section.

[S] 711.2.4.7 Energy storage systems. Where required by the *International Fire Code*, the *horizontal assembly* separating energy storage systems from the remainder of the building shall have a minimum 2-hour fire-resistance rating.

711.2.5 Ceiling panels. Where the weight of lay-in ceiling panels, used as part of fire-resistance-rated floor/ceiling or roof/ceiling assemblies, is not adequate to resist an upward force of 1 pound per square foot (48 Pa), wire or other *approved* devices shall be installed above the panels to prevent vertical displacement under such upward force.

711.2.6 Unusable space. In 1-hour fire-resistance-rated floor/ceiling assemblies, the ceiling membrane is not required to be installed over unusable crawl spaces. In 1-hour fire-resistance-rated roof assemblies, the floor membrane is not required to be installed where unusable attic space occurs above.

711.3 Nonfire-resistance-rated floor and roof assemblies. Nonfire-resistance-rated floor, floor/ceiling, roof and roof/ceiling assemblies shall comply with Sections 711.3.1 and 711.3.2.

711.3.1 Materials. Assemblies shall be of materials permitted by the building type of construction.

711.3.2 Continuity. Assemblies shall be continuous without vertical openings, except as permitted by Section 712.

SECTION 712
VERTICAL OPENINGS

[S] 712.1 General. Each vertical opening shall comply in accordance with one of the protection methods in Sections 712.1.1 through ((~~712.1.16~~)) 712.1.17.

712.1.1 Shaft enclosures. Vertical openings contained entirely within a *shaft enclosure* complying with Section 713 shall be permitted. Elevator hoistways shall be protected in accordance with Section 713.14.2.

712.1.2 Individual dwelling unit. Unconcealed vertical openings totally within an individual residential *dwelling unit* and connecting four *stories* or less shall be permitted.

712.1.3 Escalator openings. Where a building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, vertical openings for escalators shall be permitted where protected in accordance with Section 712.1.3.1 or 712.1.3.2.

712.1.3.1 Opening size. Protection by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 shall be permitted where the area of the vertical opening between *stories* does not exceed twice the horizontal projected area of the escalator. In other than Groups B and M, this application is limited to openings that do not connect more than four *stories*.

Note: NFPA 13 requires draft curtains to be at least 18 inches (457 mm) deep, and to be of noncombustible or limited-combustible material.

712.1.3.2 Automatic shutters. Protection of the vertical opening by approved shutters at every penetrated floor shall be permitted in accordance with this section. The shutters shall be of noncombustible construction and have a *fire-resistance rating* of not less than 1.5 hours. The shutter shall be so constructed as to close immediately upon the actuation of a smoke detector installed in accordance with Section 907.3.1 and shall completely shut off the well opening. Escalators shall cease operation when the shutter begins to close. The shutter shall operate at a speed of not more than 30 feet per minute (152.4 mm/s) and shall be equipped with a sensitive leading edge to arrest its progress where in contact with any obstacle, and to continue its progress on release therefrom.

712.1.4 Penetrations. Penetrations, concealed and unconcealed, shall be permitted where protected in accordance with Section 714.

712.1.5 Joints. *Joints* shall be permitted where complying with Section 712.1.5.1 or 712.1.5.2, as applicable.

712.1.5.1 Joints in or between horizontal assemblies. *Joints* made in or between *horizontal assemblies* shall comply with Section 715. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be permitted where protected in accordance with Section 715.4.

712.1.5.2 Joints in or between nonfire-resistance-rated floor assemblies. *Joints* in or between floor assemblies without a required *fire-resistance rating* shall be permitted where they comply with one of the following:

1. The *joint* shall be concealed within the cavity of a wall.
2. The *joint* shall be located above a ceiling.
3. The *joint* shall be sealed, treated or covered with an *approved* material or system to resist the free passage of flame and the products of combustion.

Exception: *Joints* meeting one of the exceptions specified in Section 715.3.

712.1.6 Ducts and air transfer openings. Penetrations by ducts and air transfer openings shall be protected in accordance with Section 717. Grease ducts shall be protected in accordance with the *International Mechanical Code*.

712.1.7 Atriums. *Atriums* complying with Section 404 that connect two or more *stories* in Group I-2 or I-3 occupancies or three or more *stories* in other occupancies shall be permitted.

Exceptions:

1. *Atriums* shall not be permitted within Group H occupancies.
2. Balconies or stories within Groups A-1, A-4 and A-5 and *mezzanines* that comply with Section 505 shall not be considered a story as it applies to this section

712.1.8 Masonry chimney. Approved vertical openings for masonry chimneys shall be permitted where the *annular space* is fireblocked at each floor level in accordance with Section 718.2.5.

712.1.9 Two-story openings. In other than Groups I-2 and I-3, a vertical opening that is not used as one of the applications specified in this section shall be permitted if the opening complies with all of the following items:

1. Does not connect more than two *stories*.
2. Does not penetrate a *horizontal assembly* that separates *fire areas* or *smoke barriers* that separate *smoke compartments*.
3. Is not concealed within the construction of a wall or a floor/ceiling assembly.
4. Is not open to a *corridor* in Group I and R occupancies.
5. Is not open to a *corridor* on nonsprinklered floors.

6. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required *shaft enclosures*.

712.1.10 Parking garages. Vertical openings in parking garages for automobile ramps, elevators and duct systems shall comply with Section 712.1.10.1, 712.1.10.2 or 712.1.10.3, as applicable.

712.1.10.1 Automobile ramps. Vertical openings for automobile ramps in parking garages shall be permitted where constructed in accordance with Sections 406.5 and 406.6.

[S] 712.1.10.2 Elevators. ((~~Vertical~~)) Non-fire-resistance rated vertical openings for elevator hoistways in parking garages that serve only the parking garage, and complying with Sections 406.5 and 406.6 ((~~, respectively,~~)) shall be permitted.

Note: When Section 712.1.10.2 is applied, the hoistway will be required to be enclosed, but it is not required to be fire-resistance rated. See Section 3020.1.

712.1.10.3 Duct systems. Vertical openings for mechanical exhaust or supply duct systems in parking garages complying with Sections 406.5 and 406.6 ((~~, respectively,~~)) shall be permitted to be unenclosed where such duct system is contained within and serves only the parking garage.

712.1.11 Mezzanine. Vertical openings between a *mezzanine* complying with Section 505 and the floor below shall be permitted.

712.1.12 Exit access stairways and ramps. Vertical openings containing *exit access stairways* or *ramps* in accordance with Section 1019 shall be permitted.

712.1.13 Openings. Vertical openings for floor fire doors and access doors shall be permitted where protected by Section 712.1.13.1 or 712.1.13.2.

712.1.13.1 Horizontal fire door assemblies. Horizontal *fire door* assemblies used to protect openings in fire-resistance-rated *horizontal assemblies* shall be tested in accordance with NFPA 288, and shall achieve a *fire-resistance rating* not less than the assembly being penetrated. Horizontal *fire door* assemblies shall be labeled by an *approved* agency. The *label* shall be permanently affixed and shall specify the manufacturer, the test standard and the *fire-resistance rating*.

712.1.13.2 Access doors. Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies, provided that such doors are tested in accordance with ASTM E119 or UL 263 as *horizontal assemblies* and labeled by an *approved agency* for such purpose.

712.1.14 Group I-3. In Group I-3 occupancies, vertical openings shall be permitted in accordance with Section 408.5.

712.1.15 Skylights. *Skylights* and other penetrations through a fire-resistance-rated roof deck or slab are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated *roof assembly* is maintained. Unprotected *skylights* shall not be permitted in *roof assemblies* required to be fire-resistance rated in accordance with Section 705.8.6. The supporting construction shall be protected to afford the required *fire-resistance rating* of the *horizontal assembly* supported.

[S] 712.1.16 Gas vents and piping. Vertical openings for penetrations of floors inside a wall cavity by gas vents and piping in buildings of Types III, IV, and V construction shall be permitted.

((~~712.1.16~~)) 712.1.17 Openings otherwise permitted. Vertical openings shall be permitted where allowed by other sections of this code.

SECTION 713
SHAFT ENCLOSURES

713.1 General. The provisions of this section shall apply to *shafts* required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies. *Interior exit stairways* and *ramps* shall be enclosed in accordance with Section 1023.

713.2 Construction. *Shaft enclosures* shall be constructed as *fire barriers* in accordance with Section 707 or *horizontal assemblies* in accordance with Section 711, or both.

713.3 Materials. *Shaft enclosures* shall be of materials permitted by the building type of construction.

[S] 713.4 Fire-resistance rating. *Shaft enclosures* shall have a *fire-resistance rating* of not less than 2 hours where connecting more than four *stories*, ((~~or more,~~)) and not less than 1 hour where connecting ((~~less than~~)) four *stories* or less. The number of *stories* connected by the *shaft enclosure* shall include any *basements* but not any *mezzanines*. *Shaft enclosures* shall have a *fire-resistance rating* not less than the floor assembly penetrated, but need not exceed 2 hours. *Shaft enclosures* shall meet the requirements of Section 703.2.1.1.

713.5 Continuity. *Shaft enclosures* shall be constructed as *fire barriers* in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, and shall have continuity in accordance with Section 707.5 for *fire barriers* or Section 711.2.2 for *horizontal assemblies*, as applicable.

713.6 Exterior walls. Where *exterior walls* serve as a part of a required *shaft enclosure*, such walls shall comply with the requirements of Section 705 for *exterior walls* and the fire-resistance-rated enclosure requirements shall not apply.

Exception: *Exterior walls* required to be fire-resistance rated in accordance with Section 1021.2 for exterior egress balconies, Section 1023.7 for *interior exit stairways* and *ramps* and Section 1027.6 for exterior *exit stairways* and *ramps.*

713.7 Openings. Openings in a *shaft enclosure* shall be protected in accordance with Section 716 as required for *fire barriers*. Doors shall be self- or automatic-closing by smoke detection in accordance with Section 716.2.6.6.

713.7.1 Prohibited openings. Openings other than those necessary for the purpose of the *shaft* shall not be permitted in *shaft enclosures*.

[S] 713.8 Penetrations. Penetrations in a *shaft enclosure* shall be protected in accordance with Section 714 as required for *fire barriers*. Structural elements, such as beams or joists, where protected in accordance with Section 714 shall be permitted to penetrate a *shaft enclosure.* See Section 3022 for installation of pipes and ducts in elevator hoistways.

713.8.1 Prohibited penetrations. Penetrations other than those necessary for the purpose of the *shaft* shall not be permitted in *shaft enclosures.*

Exception: *Membrane penetrations* shall be permitted on the outside of *shaft enclosures*. Such penetrations shall be protected in accordance with Section 714.4.2.

713.9 Joints. *Joints* in a *shaft enclosure* shall comply with Section 715.

713.10 Duct and air transfer openings. Penetrations of a *shaft enclosure* by ducts and air transfer openings shall comply with Section 717.

713.11 Enclosure at the bottom. *Shafts* that do not extend to the bottom of the building or structure shall comply with one of the following:

1. Be enclosed at the lowest level with construction of the same *fire-resistance rating* as the *lowest floor* through which the *shaft* passes, but not less than the rating required for the *shaft enclosure.*
2. Terminate in a room having a use related to the purpose of the *shaft*. The room shall be separated from the remainder of the building by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire-resistance rating* and opening protectives shall be not less than the protection required for the *shaft enclosure*.
3. Be protected by *approved fire dampers* installed in accordance with their listing at the *lowest floor* level within the *shaft enclosure*.

Exceptions:

1. The fire-resistance-rated room separation is not required, provided that the only openings in or penetrations of the *shaft enclosure* to the interior of the building occur at the bottom. The bottom of the *shaft* shall be closed off around the penetrating items with materials permitted by Section 718.3.1 for draftstopping, or the room shall be provided with an *approved automatic sprinkler system*.
2. A *shaft enclosure* containing a waste or linen chute shall not be used for any other purpose and shall discharge in a room protected in accordance with Section 713.13.4.
3. The fire-resistance-rated room separation and the protection at the bottom of the *shaft* are not required provided that there are no combustibles in the *shaft* and there are no openings or other penetrations through the *shaft enclosure* to the interior of the building.

713.12 Enclosure at top. The top of *shaft enclosures* shall comply with one of the following:

1. Extend to the underside of the roof sheathing, deck or slab of the building, and the *roof assembly* shall comply with the requirements for the type of construction as specified in Table 601.
2. Terminate below the *roof assembly* and be enclosed at the top with construction of the same *fire-resistance rating* as the topmost floor penetrated by the shaft, but not less than the *fire-resistance rating* required for the shaft enclosure.
3. Extend past the *roof assembly* and comply with the requirements of Section 1511.

713.12.1 Penthouse mechanical rooms. A fire/*smoke damper* shall not be required at the penetration of the *rooftop structure* where *shaft enclosures* extend up through the *roof assembly* into a *rooftop structure* conforming to Section 1511. Ductwork in the *shaft* shall be connected directly to HVAC equipment.

713.13 Waste, recycling and linen chutes and incinerator rooms. Waste, recycling and linen chutes shall comply with the provisions of NFPA 82, Chapter 6 and shall meet the requirements of Sections 712 and 713.13.1 through 713.13.6. Incinerator rooms shall meet the provisions of Sections 713.13.4 and 713.13.5.

Exception: Chutes serving and contained within a single *dwelling unit*.

713.13.1 Waste, recycling and linen chute enclosures. A *shaft enclosure* containing a recycling, waste or linen chute shall not be used for any other purpose and shall be enclosed in accordance with Section 713.4. A *shaft enclosure* shall be permitted to contain recycling and waste chutes. Openings into the *shaft*, from access rooms and discharge rooms, shall be protected in accordance with this section and Section 716. Openings into chutes shall not be located in *corridors*. Doors into chutes shall be *self-closing*. Discharge doors shall be self-or automatic-closing upon the actuation of a smoke detector in accordance with Section 716.2.6.6, except that heat-activated closing devices shall be permitted between the *shaft* and the discharge room.

713.13.2 Materials. A *shaft enclosure* containing a waste, recycling, or linen chute shall be constructed of materials as permitted by the building type of construction.

713.13.3 Chute access rooms. Access openings for waste, recycling or linen chutes shall be located in rooms or compartments enclosed by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Openings into the access rooms shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.2.6.6. The room or compartment shall be configured to allow the access door to the room or compartment to close and latch with the access panel to the chute in any position.

[S] 713.13.4 Chute discharge room. ((~~Table 509.1~~)) Waste, recycling or linen chutes shall discharge into an enclosed room separated by *fire barriers* with a *fire-resistance rating* not less than the required fire rating of the *shaft enclosure* and constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Openings into the discharge room from the remainder of the building shall be protected by opening protectives having a *fire protection rating* equal to the protection required for the *shaft enclosure*. Through penetrations of piping and conduit not necessary for the purpose of the chute discharge room are permitted as long as they are protected in accordance with Section 714 and do not impact the operation of the trash collection system. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.2.6.6. Waste chutes shall not terminate in an incinerator room. Waste and linen rooms that are not provided with chutes need only comply with Table 509.1.

713.13.5 Incinerator room. Incinerator rooms shall comply with Table 509.1.

713.13.6 Automatic sprinkler system. An *approved automatic sprinkler system* shall be installed in accordance with Section 903.2.11.2.

[S] 713.13.7 Chute venting and roof termination. The full diameter of waste and linen chutes shall extend a minimum of 3 feet (0.92 m) above the building roof and be gravity vented per NFPA 82.

Exceptions:

1. Waste and linen chutes are permitted to be mechanically ventilated by an exhaust fan in lieu of gravity venting. The exhaust fan shall be located outside the building at the top of the chute.
2. Where the trash chute does not extend to the highest floor of the building below the roof the trash chute shall be permitted to vent to a sidewall louver termination by gravity venting or mechanical venting. The horizontal extension of the trash chute shall have the same cross-sectional area as the chute and shall be enclosed in rated construction equal to the rating of the shaft enclosure. No operable openings shall be located within 10 feet of the sidewall louver termination.

[S] 713.14 Elevator, dumbwaiter and other hoistways. Elevator, dumbwaiter and other hoistway enclosures shall be constructed in accordance with ((~~Sections 712 and 713, and Chapter 30~~)) this section.

713.14.1 General. Elevator hoistway openings and enclosed elevator lobbies shall be provided in accordance with the following:

1. Where hoistway opening protection is required by Section 713.14.2, such protection shall be in accordance with Section 713.14.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 403.6.1.5.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 403.6.2.6.

Exception: Elevators in parking garages are permitted to comply with Section 712.1.10.

713.14.2 Hoistway opening protection required. Elevator hoistway door openings shall be protected in accordance with Section 713.14.3 where an elevator hoistway connects more than three *stories*, is required to be enclosed within a shaft enclosure in accordance with Section 712.1.1, and any of the following conditions apply:

1. The building is not protected throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The building contains a Group I-1 Condition 2 occupancy.
3. The building contains a Group I-2 occupancy.
4. The building contains a Group I-3 occupancy.
5. The building is a high rise and the elevator hoistway is more than 75 feet (22 860 mm) in height. The height of the hoistway shall be measured from the lowest floor to the highest floor of the floors served by the hoistway.

Exceptions:

1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided the level(s) of exit discharge is equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
3. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required on levels where the elevator hoistway opens to the exterior.

713.14.2.1 Rated corridors. Where *corridors* are required to be fire resistance rated in accordance with Section 1020.1, elevator hoistway openings shall be protected in accordance with Section 713.14.3.

713.14.3 Hoistway opening protection. Where Section 713.14.2 requires protection of the elevator hoistway door opening, the protection shall be provided by one of the following:

1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by fire partitions in accordance with Section 708. In addition, doors protecting openings in the elevator lobby enclosure walls shall comply with Section 716.2.2.1 as required for *corridor* walls and shall be automatic-closing by actuation of a smoke detector in accordance with Section 716.2.6.6. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for *corridors* in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2, 710.5.2.3 and 716.2.6. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for *corridors* in accordance with Section 717.5.4.1.
3. Additional doors shall be provided at each elevator hoistway door opening at the point of access to the elevator car. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal. They shall be maintained automatic closing by actuation of a smoke detector in accordance with Section 716.2.6.6. Doors that latch shall be provided with panic hardware, openable from inside the elevator car. The doors shall be readily openable from the car side without a key, tool, or special knowledge or effort.
4. The elevator hoistway shall be pressurized in accordance with Section 909.21.

713.14.4 Means of egress. Elevator lobbies shall be provided with at least one means of egress complying with Chapter 10 and other provisions in this code. Egress through an elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

[S] 713.15 Chimneys and fireplaces. *Approved* factory-built chimneys shall be installed within shafts as required by Section 713.

Exception: Factory-built chimneys that are exposed to the exterior in an *approved* manner are not required to be installed in shafts.

Approved chimneys serving multiple *dwelling units* are permitted to be installed within the same shaft, provided *approved* metal draft stops are installed at each floor level. All combustible construction shall be protected as required for *fire-resistance-rated* shaft construction. Interior shaft wall joints shall be fire-taped where required and where space allows, but fire-taping is permitted to be omitted from joints on the final closure wall provided the joints are installed in a tight manner.

The back of listed manufactured fireplace boxes is permitted to replace that portion of the shaft wall where they are located, provided the joint between the box and the adjacent shaft wall is tightly constructed and installed according to manufacturer's specification. Fresh air make-up ducts required by the Energy or Mechanical codes are permitted to pene-

trate the shaft at the fire box. Fresh air make-up ducts which pass through any portion of the building other than the shaft shall be at least 26 gage metal.

SECTION 714
PENETRATIONS

714.1 Scope. The provisions of this section shall govern the materials and methods of construction used to protect *through penetrations* and *membrane penetrations* of *horizontal assemblies* and fire-resistance-rated wall assemblies.

714.1.1 Ducts and air transfer openings. Penetrations of fire-resistance-rated walls by ducts that are not protected with *dampers* shall comply with Sections 714.3 through 714.4.3. Penetrations of *horizontal assemblies* not protected with a *shaft* as permitted by Section 717.6, and not required to be protected with *fire dampers* by other sections of this code, shall comply with Sections 714.5 through 714.6.2. Ducts and air transfer openings that are protected with *dampers* shall comply with Section 717.

714.2 Installation. A listed *penetration firestop* system shall be installed in accordance with the manufacturer's installation instructions and the listing criteria.

714.3 Installation details. Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

714.4 Fire-resistance-rated walls. Penetrations into or through *fire walls*, *fire barriers*, *smoke barrier* walls and *fire partitions* shall comply with Sections 714.4.1 through 714.4.3. Penetrations in *smoke barrier* walls shall also comply with Section 714.5.4.

714.4.1 Through penetrations. *Through penetrations* of fire-resistance-rated walls shall comply with Section 714.4.1.1 or 714.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the *annular space* between the penetrating item and the fire-resistance-rated wall is permitted to be protected by either of the following measures:

1. In concrete or masonry walls where the penetrating item is a maximum 6-inch (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (0.0929 m^2), concrete, grout or *mortar* is permitted where installed the full thickness of the wall or the thickness required to maintain the *fire-resistance rating*.
2. The material used to fill the *annular space* shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the *fire-resistance rating* of the construction penetrated.

714.4.1.1 Fire-resistance-rated assemblies. *Through penetrations* shall be protected using systems installed as tested in the *approved* fire-resistance-rated assembly.

714.4.1.2 Through-penetration firestop system. *Through penetrations* shall be protected by an *approved penetration firestop* system installed as tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an *F rating* of not less than the required *fire-resistance rating* of the wall penetrated.

714.4.2 Membrane penetrations. *Membrane penetrations* shall comply with Section 714.4.1. Where walls or partitions are required to have a *fire-resistance rating*, recessed fixtures shall be installed such that the required *fire resistance* will not be reduced.

Exceptions:

1. *Membrane penetrations* of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0 103 m^2) in area, provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet (9.29 m^2) of wall area. The *annular space* between the wall membrane and the box shall not exceed 1/8 inch (3.2 mm). Such boxes on opposite sides of the wall or partition shall be separated by one of the following:
    1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
    1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag *mineral wool* insulation.
    1.3. By solid *fireblocking* in accordance with Section 718.2.1.

Exceptions:

1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a *T rating*.
2. Floor penetrations by floor drains, tub drains or shower drains contained and located within the concealed space of a *horizontal assembly* do not require a *T rating*.
3. Floor penetrations of maximum 4-inch (102 mm) nominal diameter metal conduit or tubing penetrating directly into metal-enclosed electrical power switchgear do not require a *T rating*.

[S] 714.5.2 Membrane penetrations. Penetrations of membranes that are part of a *horizontal assembly* shall comply with Section 714.5.1.1 or 714.5.1.2. Where floor/ceiling assemblies are required to have a *fire-resistance rating*, recessed fixtures shall be installed such that the required *fire resistance* will not be reduced.

Exceptions:

1. *Membrane penetrations* by steel, ferrous or copper conduits, pipes, tubes or vents, or concrete or masonry items where the *annular space* is protected either in accordance with Section 714.5.1 or to prevent the free passage of flame and the products of combustion. The aggregate area of the openings through the membrane shall not exceed 100 square inches (64 500 mm^2) in any 100 square feet (9.3 m^2) of ceiling area in assemblies tested without penetrations.
2. Ceiling *membrane penetrations* of maximum 2-hour *horizontal assemblies* by steel electrical boxes that do not exceed 16 square inches (10 323 mm^2) in area, provided that the aggregate area of such penetrations does not exceed 100 square inches (44 500 mm^2) in any 100 square feet (9.29 m^2) of ceiling area, and the *annular space* between the ceiling membrane and the box does not exceed 1/8 inch (3.2 mm).
3. *Membrane penetrations* by electrical boxes of any size or type, that have been *listed* as part of an opening protective material system for use in *horizontal assemblies* and are installed in accordance with the instructions included in the listing.
4. *Membrane penetrations* by *listed* electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The *annular space* between the ceiling membrane and the box shall not exceed 1/8 inch (3.2 mm) unless *listed* otherwise.
5. The *annular space* created by the penetration of a fire sprinkler, provided that it is covered by a metal escutcheon plate.
6. Noncombustible items that are cast into concrete *building elements* and that do not penetrate both top and bottom surfaces of the element.
7. The ceiling membrane of a maximum 2-hour fire-resistance-rated *horizontal assembly* is permitted to be interrupted with the double wood top plate of a wall assembly that is sheathed with Type X *gypsum wallboard*, provided that all penetrating items through the double top plates are protected in accordance with Section 714.5.1.1 or 714.5.1.2 and the ceiling membrane is tight to the top plates.
8. Ceiling *membrane penetrations* by listed luminaires (light fixtures) or by luminaires protected with *listed* materials, which have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
9. Natural ventilation openings are permitted in the enclosed underside of combustible balconies and decks provided the closest edge of the vent opening is not more than 12 inches from the outer edge of the balcony or deck. Such vents must be covered with non-combustible corrosion resistant metal mesh. Solid blocking shall be installed between projecting framing members at the exterior building wall.

714.5.3 Dissimilar materials. Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the *fire-resistance* integrity of the *horizontal assembly* is maintained.

714.5.4 Penetrations in smoke barriers. Penetrations in *smoke barriers* shall be protected by an approved *through-penetration firestop system* installed and tested in accordance with the requirements of UL 1479 for air leakage. The *L rating* of the system measured at 0.30 inch (7.47 Pa) of water in both the ambient temperature and elevated temperature tests shall not exceed either of the following:

1. 5.0 cfm per square foot (0.025 $m^3/s \times m^2$) of penetration opening for each *through-penetration firestop system*.
2. A total cumulative leakage of 50 cfm (0.024 m^3/s) for any 100 square feet (9.3 m^2) of wall area, or floor area.

714.6 Nonfire-resistance-rated assemblies. Penetrations of nonfire-resistance-rated floor or floor/ceiling assemblies or the ceiling membrane of a nonfire-resistance-rated roof/ceiling assembly shall meet the requirements of Section 713 or shall comply with Section 714.6.1 or 714.6.2.

715.5 Exterior curtain wall/nonfire-resistance-rated floor assembly intersections. Voids created at the intersection of exterior curtain wall assemblies and nonfire-resistance-rated floor or floor/ceiling assemblies shall be filled with an *approved* material or system to retard the interior spread of fire and hot gases between *stories*.

715.6 Exterior curtain wall/vertical fire barrier intersections. Voids created at the intersection of nonfire-resistance-rated exterior curtain wall assemblies and vertical *fire barriers* shall be filled with an approved material or system to retard the interior spread of fire and hot gases.

715.7 Curtain wall spandrels. Height and *fire-resistance* requirements for curtain wall spandrels shall comply with Section 705.8.5. Where Section 705.8.5 does not require fire-resistance-rated curtain wall spandrels, the requirements of Sections 715.4 and 715.5 shall still apply to the intersection between the curtain wall spandrels and the floor.

715.8 Joints and voids in smoke barriers. *Fire-resistant joint systems* protecting *joints* in *smoke barriers*, and perimeter fire containment systems protecting voids at the intersection of a horizontal *smoke barrier* and an exterior curtain wall, shall be tested in accordance with the requirements of UL 2079 for air leakage. The L rating of the joint system shall not exceed 5 cubic feet per minute per linear foot (0.00775 m^3/s m) of joint at 0.30 inch (74.7 Pa) of water for both the ambient temperature and elevated temperature tests.

SECTION 716
OPENING PROTECTIVES

716.1 General. Opening protectives required by other sections of this code shall comply with the provisions of this section and shall be installed in accordance with NFPA 80.

[S] 716.1.1 Alternative methods for determining fire protection ratings. The application of any of the alternative methods specified in this section shall be based on the fire exposure and acceptance criteria specified in NFPA 252, NFPA 257, UL 9, UL 10B or UL 10C. The required *fire resistance* of an opening protective shall be permitted to be established by any of the following methods or procedures:

1. Designs documented in *approved* sources.
2. Calculations performed in an *approved* manner.
3. Engineering analysis based on a comparison of opening protective designs having *fire protection ratings* as determined by the test procedures set forth in NFPA 252, NFPA 257, UL 9, UL 10B or UL 10C.
4. Alternative protection methods as allowed by Section ((~~104.11~~)) 104.5.

716.1.2 Glazing. Glazing used in *fire door assemblies* and *fire window assemblies* shall comply with this section in addition to the requirements of Sections 716.2 and 716.3, respectively.

716.1.2.1 Safety glazing. *Fire-protection-rated* glazing and fire-resistance-rated glazing installed in *fire door* assemblies and *fire window assemblies* shall comply with the safety glazing requirements of Chapter 24 where applicable.

716.1.2.2 Marking fire-rated glazing assemblies. *Fire-rated glazing* assemblies shall be marked in accordance with Tables 716.1(1), 716.1(2) and 716.1(3).

TABLE 716.1(1)
MARKING FIRE-RATED GLAZING ASSEMBLIES

FIRE TEST STANDARD	MARKING	DEFINITION OF MARKING
ASTM E119 or UL 263	W	Meets wall assembly criteria.
ASTM E119 or UL 263	FC	Meets floor/ceiling criteria[a]
NFPA 257 or UL 9	OH	Meets fire window assembly criteria including the hose stream test.
NFPA 252 or UL 10B or UL 10C	D	Meets fire door assembly criteria.
	H	Meets fire door assembly hose stream test.
	T	Meets 450°F temperature rise criteria for 30 minutes
—	XXX	The time in minutes of the fire resistance or fire protection rating of the glazing assembly.

For SI: °C = [(°F) – 32]/1.8.
a. See Section 2409.1

716.2.5.1.1 Fire-resistance-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour. Fire-resistance-rated glazing tested to ASTM E119 or UL 263 and NFPA 252, UL 10B or UL 10C shall be permitted in *fire door assemblies* located in *fire walls* and in *fire barriers* in accordance with Table 716.1(2) to the maximum size tested and in accordance with their listings.

716.2.5.1.2 Fire-protection-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour. Fire-protection-rated glazing shall be prohibited in *fire walls* and *fire barriers* except as provided in Sections 716.2.5.1.2.1 and 716.2.5.1.2.2.

716.2.5.1.2.1 Horizontal exits. Fire-protection-rated glazing shall be permitted as vision panels in *self-closing* swinging *fire door assemblies* serving as horizontal exits in *fire walls* where limited to 100 square inches (0.065 m^2).

716.2.5.1.2.2 Fire barriers. Fire-protection-rated glazing shall be permitted in *fire doors* having a 1-1/2-hour *fire protection rating* intended for installation in *fire barriers*, where limited to 100 square inches (0.065 m^2).

716.2.5.2 Elevator, stairway and ramp protectives. Approved fire-protection-rated glazing used in *fire door assemblies* in elevator, *stairway and ramp enclosures* shall be so located as to furnish clear vision of the passageway or approach to the elevator, *stairway* or *ramp*.

716.2.5.3 Glazing in door assemblies in corridors and smoke barriers. In a 20-minute *fire door assembly*, the glazing material in the door itself shall have a minimum fire-protection-rated glazing of 20 minutes and shall be exempt from the hose stream test.

716.2.5.4 Fire door frames with transom lights and sidelights. Fire-protection-rated glazing shall be permitted in door frames with transom lights, sidelights or both, where a 3/4-hour *fire protection rating* or less is required and in 2-hour fire-resistance-rated *exterior walls* in accordance with Table 716.1(2). *Fire door* frames with transom lights, sidelights or both, installed with fire-resistance-rated glazing tested as an assembly in accordance with ASTM E119 or UL 263 shall be permitted where a *fire protection rating* exceeding 3/4 hour is required in accordance with Table 716.1(2).

716.2.5.4.1 Energy storage system separation. Fire-protection-rated glazing shall not be permitted in *fire door* frames with transom lights and sidelights in *fire barriers* required by Section 1207 of the *International Fire Code* to enclose energy storage systems.

[W] 716.2.6 Fire door hardware and closures. *Fire door* hardware and closures shall be installed on *fire door assemblies* in accordance with the requirements of this section.

716.2.6.1 Door closing. *Fire doors* shall be latching and self- or automatic-closing in accordance with this section.

Exceptions:

1. *Fire doors* located in common walls separating *sleeping units* in Group R-1 shall be permitted without automatic- or *self-closing* devices.
2. The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with ((~~Section 3003.2~~)) Chapter 30 shall be permitted to remain open during Phase I emergency recall operation.
3. In Group I-1, Condition 2 *Assisted living facilities* licensed under chapter 388-78A WAC and residential treatment facilities licensed under chapter 246-337 WAC, fire doors in dwelling and sleeping units opening to the *corridor* shall be permitted without automatic or self-closing devices when all of the following conditions exist:
   - 3.1. Each floor is constantly attended by staff on a 24-hour basis and stationed on that floor;
   - 3.2. The facility is provided with an NFPA 13 sprinkler system throughout;
   - 3.3. Doors shall be equipped with positive latching;
   - 3.4. Dwelling and sleeping units are not equipped with cooking appliances;
   - 3.5. Dwelling and sleeping units shall be equipped with a smoke detection system interconnected with the smoke detection system required by Section 907.2.6.1.

716.2.6.2 Latch required. Unless otherwise specifically permitted, single side-hinged *swinging fire doors* and both leaves of pairs of side-hinged swinging *fire doors* shall be provided with an active latch bolt that will secure the door when it is closed.

716.2.6.3 Chute intake door latching. Chute intake doors shall be positive latching, remaining latched and closed in the event of latch spring failure during a fire emergency.

716.2.6.4 Automatic-closing fire door assemblies. Automatic-closing *fire door assemblies* shall be *self-closing* in accordance with NFPA 80.

716.2.6.5 Delayed-action closers. Doors required to be *self-closing* and not required to be automatic closing shall be permitted to be equipped with *delayed-action closers*.

[S] 716.2.6.6 Smoke-activated doors. Automatic-closing doors installed in the following locations shall be permitted to have hold-open devices. Doors shall automatically close by the actuation of *smoke detectors* installed in accordance with Section 907.3 or by loss of power to the smoke *detector* or hold-open device. Doors that are automatic-closing by smoke detection shall not have more than a 10-second delay before the door starts to close after the smoke detector is actuated. Automatic-closing doors that protect openings installed in the following locations shall comply with this section:

1. In walls that separate incidental uses in accordance with Section 509.4.
2. In *fire walls* in accordance with Section 706.8.
3. In *fire barriers* in accordance with Section 707.6.
4. In *fire partitions* in accordance with Section 708.6.
5. In *smoke barriers* in accordance with Section 709.5.
6. In *smoke partitions* in accordance with Section 710.5.2.3.
7. In *shaft enclosures* in accordance with Section 713.7.
8. In waste and linen chutes, discharge openings and access and discharge rooms in accordance with Section 713.13. Loading doors installed in waste and linen chutes shall meet the requirements of Sections 716.2.6.1 and 716.2.6.3.
9. Additional doors provided at elevator hoistway door openings installed in accordance with Section 713.14.3 item 3.

716.2.6.7 Doors in pedestrian ways. Vertical sliding or vertical rolling steel *fire doors* in openings through which pedestrians travel shall be heat activated or activated by smoke detectors with alarm verification.

716.2.7 Swinging fire shutters. Where fire shutters of the swinging type are installed in exterior openings, not less than one row in every three vertical rows shall be arranged to be readily opened from the outside, and shall be identified by distinguishing marks or letters not less than 6 inches (152 mm) high.

716.2.8 Rolling fire shutters. Where fire shutters of the rolling type are installed, such shutters shall include *approved* automatic-closing devices.

716.2.9 Labeled protective assemblies. *Fire door* assemblies shall be labeled by an *approved agency*. The *labels* shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

716.2.9.1 Fire door labeling requirements. *Fire doors* shall be *labeled* showing the name of the manufacturer or other identification readily traceable back to the manufacturer, the name or trademark of the third-party inspection agency, the *fire protection rating* and, where required for *fire doors* in *interior exit stairways and ramps* and *exit passageways* by Section 716.2.2.3, the maximum transmitted temperature end point. Smoke and draft control doors complying with UL 1784 shall be *labeled* as such and shall comply with Section 716.2.9.3. *Labels* shall be *approved* and permanently affixed. The *label* shall be applied at the factory or location where fabrication and assembly are performed.

716.2.9.1.1 Light kits, louvers and components. *Listed* light kits and louvers and their required preparations shall be considered as part of the *labeled* door where such installations are done under the listing program of the third-party agency. *Fire doors* and *fire door assemblies* shall be permitted to consist of components, including glazing, vision light kits and hardware that are *listed* or classified and *labeled* for such use by different third-party agencies.

716.2.9.2 Oversized doors. Oversized *fire doors* shall bear an oversized *fire door label* by an *approved agency* or shall be provided with a certificate of inspection furnished by an *approved* testing agency. Where a certificate of inspection is furnished by an *approved* testing agency, the certificate shall state that the door conforms to the requirements of design, materials and construction, but has not been subjected to the fire test.

716.2.9.3 Smoke and draft control door labeling requirements. Smoke and draft control doors complying with UL 1784 shall be *labeled* in accordance with Section 716.2.9.1 and shall show the letter "S" on the fire-rating *label* of the door. This marking shall indicate that the door and frame assembly are in compliance where *listed or labeled* gasketing is installed.

716.2.9.4 Fire door frame labeling requirements. *Fire door* frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.

716.2.9.5 Labeling. *Fire-rated glazing* shall bear a *label* or other identification showing the name of the manufacturer, the test standard and information required in Table 716.1(1) that shall be issued by an *approved agency* and shall be permanently identified on the glazing.

716.2.9.6 Fire door operator labeling requirements. *Fire door* operators for horizontal sliding doors shall be *labeled* and *listed* for use with the assembly.

TABLE 717.3.2.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

717.3.2.2 Smoke damper ratings. *Smoke damper* leakage ratings shall be Class I or II. Elevated temperature ratings shall be not less than 250°F (121°C).

717.3.2.3 Combination fire/smoke damper ratings. *Combination fire/smoke dampers* shall have the minimum *rating* specified for *fire dampers* in Table 717.3.2.1 and shall have the minimum rating specified for *smoke dampers* in Section 717.3.2.2.

717.3.2.4 Corridor damper ratings. *Corridor dampers* shall have the following minimum ratings:

1. One-hour *fire-resistance rating*.
2. Class I or II leakage rating as specified in Section 717.3.2.2.

717.3.3 Damper actuation. *Damper* actuation shall be in accordance with Sections 717.3.3.1 through 717.3.3.5 as applicable.

717.3.3.1 Fire damper actuation. Primary heat responsive devices used to actuate *fire dampers* shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909.

Interpretation I717.3: Dampers associated with exhaust fans used for hoistway and stair pressurization are permitted to comply with Section 717.3.3.1, item 2.

717.3.3.2 Smoke damper actuation. The *smoke damper* shall close upon actuation of a *listed smoke detector* or detectors installed in accordance with Section 907.3 and one of the following methods, as applicable:

1. Where a *smoke damper* is installed within a duct, a *smoke detector* shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet (1524 mm) of the *damper*. Air outlets and inlets shall not be located between the detector or tubes and the *damper*. The detector shall be *listed* for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, *dampers* shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a *smoke damper* is installed above *smoke barrier* doors in a *smoke barrier*, a spot-type detector shall be installed on either side of the *smoke barrier* door opening. The detector shall be *listed* for releasing service if used for direct interface with the *damper*.
3. Where a *smoke damper* is installed within an air transfer opening in a wall, a spot-type detector shall be installed within 5 feet (1524 mm) horizontally of the *damper*. The detector shall be *listed* for releasing service if used for direct interface with the *damper*.
4. Where a *smoke damper* is installed in a corridor wall or ceiling, the *damper* shall be permitted to be controlled by a smoke detection system installed in the *corridor*.
5. Where a smoke detection system is installed in all areas served by the duct in which the *damper* will be located, the *smoke dampers* shall be permitted to be controlled by the smoke detection system.

717.3.3.3 Combination fire/smoke damper actuation. *Combination fire/smoke damper* actuation shall be in accordance with Sections 717.3.3.1 and 717.3.3.2. *Combination fire/smoke dampers* installed in smoke control system *shaft* penetrations shall not be activated by local area smoke detection unless it is secondary to the smoke management system controls.

717.3.3.4 Ceiling radiation damper actuation. The operating temperature of a *ceiling radiation damper* actuation device shall be 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

717.3.3.5 Corridor damper actuation. *Corridor damper* actuation shall be in accordance with Sections 717.3.3.1 and 717.3.3.2.

717.4 Access and identification. Access and identification of fire and *smoke dampers* shall comply with Sections 717.4.1 through 717.4.2.

717.4.1 Access. *Fire* and *smoke dampers* shall be provided with an approved means of access that is large enough to permit inspection and maintenance of the *damper* and its operating parts. *Dampers* equipped with fusible links, internal operators, or both shall be provided with an access door that is not less than 12 inches (305 mm) square or provided with a removable duct section.

717.4.1.1 Access openings. The access shall not affect the integrity of *fire-resistance-rated* assemblies. The access openings shall not reduce the *fire-resistance rating* of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

717.4.1.2 Restricted access. Where space constraints or physical barriers restrict access to a damper for periodic inspection and testing, the *damper* shall be a single- or multi-blade type *damper* and shall comply with the remote inspection requirements of NFPA 80 or NFPA 105.

717.4.2 Identification. Access points shall be permanently identified on the exterior by a label having letters not less than 1/2 inch (12.7 mm) in height reading: "FIRE/SMOKE DAMPER," "SMOKE DAMPER" or "FIRE DAMPER."

717.5 Where required. *Fire dampers, smoke dampers, combination fire/smoke dampers, ceiling radiation dampers* and *corridor dampers* shall be provided at the locations prescribed in Sections 717.5.1 through 717.5.7 and 717.6. Where an assembly is required to have both *fire dampers* and *smoke dampers, combination fire/smoke dampers* or a *fire damper* and a *smoke damper* shall be provided.

717.5.1 Fire walls. Ducts and air transfer openings permitted in *fire walls* in accordance with Section 706.11 shall be protected with *listed fire dampers* installed in accordance with their listing.

717.5.1.1 Horizontal exits. A *listed smoke damper* designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a *fire wall* that serves as a *horizontal exit.*

717.5.2 Fire barriers. Ducts and air transfer openings of *fire barriers* shall be protected with *listed fire dampers* installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for *interior exit stairways* and *ramps* and *exit passageways*, except as permitted by Sections 1023.5 and 1024.6, respectively.

Exceptions: *Fire dampers* are not required at penetrations of *fire barriers* where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an *approved* smoke control system in accordance with Section 909 and where the use of a *fire damper* would interfere with the operation of a smoke control system.
3. Such walls are penetrated by fully ducted HVAC systems, have a required *fire-resistance rating* of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a fully ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals. Nonmetal flexible air connectors shall be permitted in the following locations:
   3.1. At the duct connection to the air handling unit or equipment located within the mechanical room in accordance with Section 603.9 of the *International Mechanical Code.*
   3.2. From an overhead metal duct to a ceiling diffuser within the same room in accordance with Section 603.6.2 of the *International Mechanical Code.*

717.5.2.1 Horizontal exits. A *listed smoke damper* designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a *fire barrier* that serves as a *horizontal exit*.

[S] 717.5.3 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with *listed* fire and *smoke dampers* installed in accordance with their listing.

Exceptions:

1. *Fire dampers* are not required at penetrations of *shafts* where any of the following criteria are met:
   1.1. Steel exhaust subducts having a wall thickness of not less than 0.0187 inch (0.4712 mm) are extended not less than 22 inches (559 mm) vertically in exhaust *shafts*, and an exhaust fan is installed at the upper terminus of the *shaft* that is powered continuously in accordance with Section 909.11, so as to maintain a continuous upward airflow to the outdoors.
   1.2. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
   1.3. Ducts are used as part of an *approved* smoke control system designed and installed in accordance with Section 909 and where the *fire damper* will interfere with the operation of the smoke control system.

1.4. The penetrations are in parking garage exhaust or supply *shafts* that are separated from other building *shafts* by not less than 2-hour fire-resistance-rated construction.

2. In Group B and R occupancies equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, *smoke dampers* are not required at penetrations of *shafts* where all of the following criteria are met:

2.1. Kitchen, clothes dryer, bathroom, ((~~and~~)) toilet room, accessory storage, and accessory trash room exhaust openings are installed with steel exhaust subducts, having a wall thickness of not less than 0.0187 inch (0.4712 mm).

2.2. The subducts extend not less than 22 inches (559 mm) vertically.

2.3. An exhaust fan is installed at the upper terminus of the *shaft* that is ((~~powered continuously in accordance with the provisions of Section 909.11,~~)) provided with a *legally required standby power system* in accordance with *Seattle Electrical Code* Section 701 so as to maintain a continuous upward airflow to the outdoors.

3. *Smoke dampers* are not required at penetration of exhaust or supply *shafts* in parking garages that are separated from other building *shafts* by not less than 2-hour fire-resistance-rated construction.

4. *Smoke dampers* are not required at penetrations of *shafts* where ducts are used as part of an *approved* mechanical smoke control system designed in accordance with Section 909 and where the *smoke damper* will interfere with the operation of the smoke control system.

5. *Fire dampers* and *combination fire/smoke dampers* are not required in kitchen and clothes dryer exhaust systems where *dampers* are prohibited by the *International Mechanical Code*.

717.5.3.1 Continuous upward airflow. *Fire dampers* and *smoke dampers* shall not be installed in *shafts* that are required to maintain a continuous upward airflow path where closure of the *damper* would result in the loss of the airflow.

[S] 717.5.4 Fire partitions. Ducts and air transfer openings that penetrate *fire partitions* shall be protected with *listed fire dampers* installed in accordance with their listing.

Exceptions: In occupancies other than Group H, *fire dampers* are not required where any of the following apply:

1. *Corridor* walls in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and the duct is protected as a *through penetration* in accordance with Section 714.
2. Tenant partitions in *covered and open mall buildings* where the walls are not required by provisions elsewhere in the code to extend to the underside of the floor or roof sheathing, slab or deck above.
3. The duct system is constructed of *approved* materials in accordance with the *International Mechanical Code* and the duct penetrating the wall complies with all of the following requirements:

3.1. The duct shall not exceed 100 square inches (0.06 m^2).

3.2. The duct shall be constructed of steel not less than 0.0217 inch (0.55 mm) in thickness.

3.3. The duct shall not have openings that communicate the *corridor* with adjacent spaces or rooms.

3.4. The duct shall be installed above a ceiling.

3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.

3.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1-1/2-inch by 1-1/2-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The *annular space* between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.

4. Such walls are penetrated by ducted HVAC systems, have a required *fire-resistance rating* of 1 hour or less, and are in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals. Nonmetal flexible air connectors shall be permitted in the following locations:

4.1. At the duct connection to the air handling unit or equipment located within the mechanical room in accordance with Section 603.9 of the *International Mechanical Code*.

4.2. From an overhead metal duct to a ceiling diffuser within the same room in accordance with Section 603.6.2 of the *International Mechanical Code*.

shall be installed with a material specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and resist the free passage of flame and the products of combustion.

718.2.5.1 Factory-built chimneys and fireplaces. Factory-built chimneys and fireplaces shall be fireblocked in accordance with UL 103 and UL 127.

718.2.6 Exterior wall coverings. *Fireblocking* shall be installed within concealed spaces of *exterior wall coverings* and other exterior architectural elements where permitted to be of combustible construction as specified in Section 1405 or where erected with combustible frames. *Fireblocking* shall be installed at maximum intervals of 20 feet (6096 mm) in either dimension so that there will be no concealed space exceeding 100 square feet (9.3 m^2) between *fireblocking*. Where wood furring strips are used, they shall be of *approved* wood of natural decay resistance or *preservative-treated wood*. If noncontinuous, such elements shall have closed ends, with not less than 4 inches (102 mm) of separation between sections.

Exceptions:

1. *Fireblocking* of *cornices* is not required in single-family *dwellings. Fireblocking* of *cornices* of a two-family *dwelling* is required only at the line of *dwelling unit* separation.
2. *Fireblocking* shall not be required where the *exterior wall covering* is installed on noncombustible framing and the face of the *exterior wall covering* exposed to the concealed space is covered by one of the following materials:
   2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
   2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
   2.3. Other *approved* noncombustible materials.
3. *Fireblocking* shall not be required where the *exterior wall covering* has been tested in accordance with, and complies with the acceptance criteria of, NFPA 285. The *exterior wall covering* shall be installed as tested in accordance with NFPA 285.

718.2.7 Concealed sleeper spaces. Where wood sleepers are used for laying wood flooring on masonry or concrete fire-resistance-rated floors, the space between the floor slab and the underside of the wood flooring shall be filled with an *approved* material to resist the free passage of flame and products of combustion or fireblocked in such a manner that open spaces under the flooring shall not exceed 100 square feet (9.3 m^2) in area and such space shall be filled solidly under permanent partitions so that communication under the flooring between adjoining rooms shall not occur.

Exceptions:

1. *Fireblocking* is not required for slab-on-grade floors in gymnasiums.
2. *Fireblocking* is required only at the juncture of each alternate lane and at the ends of each lane in a bowling facility.

718.3 Draftstopping in floors. Draftstopping shall be installed to subdivide floor/ceiling assemblies where required by Section 708.4.2. In other than Group R occupancies, draftstopping shall be installed to subdivide combustible floor/ceiling assemblies so that horizontal floor areas do not exceed 1,000 square feet (93 m^2).

Exception: Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

718.3.1 Draftstopping materials. Draftstopping materials shall be not less than 1/2-inch (12.7 mm) *gypsum board,* 3/8-inch (9.5 mm) *wood structural panel*, 3/8-inch (9.5 mm) *particleboard,* 1-inch (25-mm) nominal lumber, cement *fiberboard*, batts or blankets of mineral wool or glass fiber, or other *approved* materials adequately supported. The integrity of *draftstops* shall be maintained.

718.4 Draftstopping in attics. Draftstopping shall be installed to subdivide *attic* spaces where required by Section 708.4.2. In other than Group R, draftstopping shall be installed to subdivide combustible *attic* spaces and combustible concealed roof spaces such that any horizontal area does not exceed 3,000 square feet (279 m^2). *Ventilation* of concealed roof spaces shall be maintained in accordance with Section 1202.2.1.

Exception: Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

718.4.1 Draftstopping materials. Materials utilized for draftstopping of *attic* spaces shall comply with Section 718.3.1.

718.4.1.1 Openings. Openings in the partitions shall be protected by *self-closing* doors with automatic latches constructed as required for the partitions.

[S] 718.5 Combustible materials in concealed spaces in Type I or II construction. Combustible materials shall not be permitted in concealed spaces of buildings of Type I or II construction.

Exceptions:

1. Combustible materials in accordance with Section 603.

2. Combustible materials exposed within plenums complying with Section 602 of the *International Mechanical Code*.
3. Class A *interior finish* materials classified in accordance with Section 803.
4. Combustible piping within partitions or shaft enclosures installed in accordance with the provisions of this code.
5. Combustible piping within concealed ceiling spaces installed in accordance with the *International Mechanical Code* and the ((~~*International*~~)) *Uniform Plumbing Code*.
6. Combustible insulation and covering on pipe and tubing, installed in concealed spaces other than plenums, complying with Section 720.7.

SECTION 719
FIRE-RESISTANCE REQUIREMENTS FOR PLASTER

719.1 Thickness of plaster. The minimum thickness of *gypsum plaster* or Portland *cement plaster* used in a fire-resistance-rated system shall be determined by the prescribed fire tests. The plaster thickness shall be measured from the face of the lath where applied to gypsum lath or metal lath.

719.2 Plaster equivalents. For *fire-resistance* purposes, 1/2 inch (12.7 mm) of unsanded *gypsum plaster* shall be deemed equivalent to 3/4 inch (19.1 mm) of one-to-three gypsum sand plaster or 1 inch (25 mm) of Portland cement sand plaster.

719.3 Noncombustible furring. In buildings of Types I and II construction, plaster shall be applied directly on concrete or masonry or on *approved* noncombustible plastering base and furring.

719.4 Double reinforcement. Plaster protection more than 1 inch (25 mm) in thickness shall be reinforced with an additional layer of *approved* lath embedded not less than 3/4 inch (19.1 mm) from the outer surface and fixed securely in place.

Exception: Solid plaster partitions or where otherwise determined by fire tests.

719.5 Plaster alternatives for concrete. In reinforced concrete construction, *gypsum plaster* or Portland *cement plaster* is permitted to be substituted for 1/2 inch (12.7 mm) of the required poured concrete protection, except that a minimum thickness of 3/8 inch (9.5 mm) of poured concrete shall be provided in reinforced concrete floors and 1 inch (25 mm) in reinforced concrete columns in addition to the plaster finish. The concrete base shall be prepared in accordance with Section 2510.7.

SECTION 720
THERMAL- AND SOUND-INSULATING MATERIALS

720.1 General. Insulating materials shall comply with the requirements of this section. Where a *flame spread index* or a *smoke-developed index* is specified in this section, such index shall be determined in accordance with ASTM E84 or UL 723. Any material that is subject to an increase in *flame spread index* or *smoke-developed index* beyond the limits herein established through the effects of age, moisture or other atmospheric conditions shall not be permitted. Insulating materials, when tested in accordance with the requirements of this section, shall include facings, when used, such as vapor retarders, vapor permeable membranes and similar coverings, and all layers of single and multilayer reflective foil insulation and similar materials.

Exceptions:

1. *Fiberboard* insulation shall comply with Chapter 23.
2. Foam plastic insulation shall comply with Chapter 26.
3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the *International Mechanical Code*.
4. All layers of single and multilayer reflective plastic core insulation shall comply with Section 2614.

720.2 Concealed installation. Insulating materials, where concealed as installed in buildings of any type of construction, shall have a *flame spread index* of not more than 25 and a *smoke-developed index* of not more than 450.

Exception: Cellulosic fiber loose-fill insulation complying with the requirements of Section 720.6 shall not be required to meet a *flame spread index* requirement but shall be required to meet a *smoke-developed index* of not more than 450 when tested in accordance with CAN/ULC S102.2.

720.2.1 Facings. Where such materials are installed in concealed spaces in buildings of Type III, IV or V construction, the *flame spread* and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

Exception: All layers of single and multilayer reflective plastic core insulation shall comply with Section 2614.

720.3 Exposed installation. Insulating materials, where exposed as installed in buildings of any type of construction, shall have a *flame spread index* of not more than 25 and a *smoke-developed index* of not more than 450.

SECTION 804
INTERIOR FLOOR FINISH

804.1 General. *Interior floor finish* and floor covering materials shall comply with Sections 804.2 through 804.4.2.

Exception: Floor finishes and coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials that are not composed of fibers.

804.2 Classification. *Interior floor finish* and floor covering materials required by Section 804.4.2 to be of Class I or II materials shall be classified in accordance with ASTM E648 or NFPA 253. The classification referred to herein corresponds to the classifications determined by ASTM E648 or NFPA 253 as follows: Class I, 0.45 watts/cm^2 or greater; Class II, 0.22 watts/cm^2 or greater.

804.3 Testing and identification. *Interior floor finish* and floor covering materials shall be tested by an agency in accordance with ASTM E648 or NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the *interior floor finish* or floor covering classification in accordance with Section 804.2. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the building official on request.

804.4 Interior floor finish requirements. Interior floor covering materials shall comply with Sections 804.4.1 and 804.4.2 and *interior floor finish* materials shall comply with Section 804.4.2.

804.4.1 Test requirement. In all occupancies, interior floor covering materials shall comply with the requirements of the DOC FF-1 "pill test" (CPSC 16 CFR Part 1630) or with ASTM D2859.

804.4.2 Minimum critical radiant flux. In all occupancies, *interior floor finish* and floor covering materials in enclosures for *stairways* and *ramps*, exit passageways, *corridors* and rooms or spaces not separated from corridors by partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux. The minimum critical radiant flux shall be not less than Class I in Groups I-1, I-2 and I-3 and not less than Class II in Groups A, B, E, H, I-4, M, R-1, R-2 and S.

Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, Class II materials are permitted in any area where Class I materials are required, and materials complying with DOC FF-1 "pill test" (CPSC 16 CFR Part 1630) or with ASTM D2859 are permitted in any area where Class II materials are required.

SECTION 805
COMBUSTIBLE MATERIALS IN TYPES I AND II CONSTRUCTION

805.1 Application. Combustible materials installed on or embedded in floors of buildings of Type I or II construction shall comply with Sections 805.1.1 through 805.1.3.

Exception: *Stages* and *platforms* constructed in accordance with Sections 410.2 and 410.3, respectively.

805.1.1 Subfloor construction. Floor sleepers, bucks and nailing blocks shall not be constructed of combustible materials, unless the space between the fire-resistance-rated floor assembly and the flooring is either solidly filled with noncombustible materials or fireblocked in accordance with Section 718, and provided that such open spaces shall not extend under or through permanent partitions or walls.

[S] 805.1.2 Wood finish flooring. Wood finish flooring or wood sheathing used as flooring is permitted to be attached directly to the embedded or fireblocked wood sleepers and shall be permitted where cemented directly to the top surface of fire-resistance-rated floor assemblies or directly to a wood subfloor attached to sleepers as provided for in Section 805.1.1.

805.1.3 Insulating boards. Combustible insulating boards not more than 1/2 inch (12.7 mm) thick and covered with finish flooring are permitted where attached directly to a noncombustible floor assembly or to wood subflooring attached to sleepers as provided for in Section 805.1.1.

SECTION 806
DECORATIVE MATERIALS AND TRIM

[F] 806.1 General. The following requirements shall apply to all occupancies:

1. Furnishings or *decorative materials* of an *explosive* or highly flammable character shall not be used.
2. Fire-retardant coatings in existing buildings shall be maintained so as to retain the effectiveness of the treatment under service conditions encountered in actual use.
3. Furnishings or other objects shall not be placed to obstruct exits, access thereto, egress therefrom or visibility thereof.
4. The permissible amount of decorative vegetation and noncombustible *decorative materials* shall not be limited.

CHAPTER 9

FIRE PROTECTION AND LIFE SAFETY SYSTEMS

User note:

About this chapter: *Chapter 9 prescribes the minimum requirements for active fire protection equipment systems to perform the functions of detecting a fire, alerting the occupants or fire department of a fire emergency, mass notification, gas detection, controlling smoke and controlling or extinguishing the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the* International Fire Code®.

SECTION 901
GENERAL

901.1 Scope. The provisions of this chapter shall specify where fire protection and *life safety systems* are required and shall apply to the design, installation and operation of *fire protection* and *life safety systems*.

901.2 Fire protection and life safety systems. *Fire protection* and *life safety systems* shall be installed, repaired, operated and maintained in accordance with this code and the *International Fire Code*.

Any *fire protection or life safety system* for which an exception or reduction to the provisions of this code has been granted shall be considered to be a required system.

Exception: Any *fire protection or life safety system* or portion thereof not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code.

[S] 901.2.1 Certificates required. Individuals who install, inspect, test or maintain fire protection and *life safety* systems shall obtain the proper certificate from the *fire code official* as required by the *International Fire Code*.

901.3 Modifications. Persons shall not remove or modify any *fire protection system* installed or maintained under the provisions of this code or the *International Fire Code* without approval by the *building official*.

901.4 Threads. Threads provided for fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

[S] 901.5 Acceptance tests. *Fire protection* and *life safety systems* shall be tested in accordance with the requirements of this code and the *International Fire Code*. Where required, the tests shall be conducted in the presence of the *building official*. Tests required by this code, the *International Fire Code* and the standards listed in this code shall be conducted at the expense of the owner or the owner's authorized agent. It shall be unlawful to occupy portions of a structure until the systems required ((~~*fire protection systems*~~)) by this code and the International Fire Code within that portion of the structure have been tested and *approved*.

901.6 Supervisory service. Where required, *fire protection systems* shall be monitored by an approved supervising station in accordance with NFPA 72.

901.6.1 Automatic sprinkler systems. *Automatic sprinkler systems* shall be monitored by an *approved* supervising station.

Exceptions:

1. A supervising station is not required for *automatic sprinkler systems* protecting one- and two-family dwellings.
2. Limited area systems in accordance with Section 903.3.8.

[F] 901.6.2 Integrated testing. Where two or more fire protection or *life safety systems* are interconnected, the intended response of subordinate fire protection and *life safety systems* shall be verified when required testing of the initiating system is conducted. In addition, integrated testing shall be performed in accordance with Sections 901.6.2.1 and 901.6.2.2.

[F] 901.6.2.1 High-rise buildings. For high-rise buildings, integrated testing shall comply with NFPA 4, with an integrated test performed prior to issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

[F] 901.6.2.2 Smoke control systems. Where a fire alarm system is integrated with a smoke control system as outlined in Section 909, integrated testing shall comply with NFPA 4, with an integrated test performed prior to issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the

integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

[S] 901.6.3 Fire alarm systems. Fire alarm systems required by the provisions of Section 907.2 of this code and Sections 907.2 and 907.9 of the *International Fire Code* shall be monitored by an *approved* supervising station in accordance with Section 907.6.6 of this code.

Exceptions:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. Supervisory service is not required for *automatic sprinkler systems* in one- and two-family dwellings and townhouses.

901.6.4 Group H. Supervision and monitoring of emergency alarm, detection and automatic fire-extinguishing systems in Group H occupancies shall be in accordance with the *International Fire Code*.

901.7 Fire areas. Where buildings, or portions thereof, are divided into *fire areas* so as not to exceed the limits established for requiring a *fire protection system* in accordance with this chapter, such *fire areas* shall be separated by *fire walls* constructed in accordance with Section 706, *fire barriers* constructed in accordance with Section 707, or *horizontal assemblies* constructed in accordance with Section 711, or a combination therof having a *fire-resistance rating* of not less than that determined in accordance with Section 707.3.10.

SECTION 902
FIRE PUMP AND RISER ROOM SIZE

[F] 902.1 Pump and riser room size. Where provided, fire pump rooms and *automatic sprinkler system* riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working room around the stationary equipment. Clearances around equipment to elements of permanent construction, including other installed equipment and appliances, shall be sufficient to allow inspection, service, repair or replacement without removing such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly. Fire pump and *automatic sprinkler system* riser rooms shall be provided with doors and unobstructed passageways large enough to allow removal of the largest piece of equipment.

[F] 902.1.1 Access. Automatic sprinkler system risers, fire pumps and controllers shall be provided with ready access. Where located in a fire pump room or *automatic sprinkler system* riser room, the door shall be permitted to be locked provided that the key is available at all times.

[S] 902.1.1.1 Access to other spaces. No other rooms or spaces not related to the operation of the fire pump and its equipment shall be accessed through or by way of the fire pump room.

Exception: Equipment related to domestic water distribution are permitted to have access hatches to equipment or components for maintenance needs.

[S] [F] 902.1.2 Marking on access doors. Access doors for *automatic sprinkler system* riser rooms and fire pump rooms shall be labeled with an *approved* sign stating "FIRE SPRINKLER RISER ROOM" or "FIRE PUMP AND RISER ROOM". The lettering shall be in contrasting color to the background. Letters shall have a minimum height of 2 inches (51 mm) with a minimum stroke of 3/8 inch (10 mm).

[F] 902.1.3 Environment. Automatic sprinkler system riser rooms and fire pump rooms shall be maintained at a temperature of not less than 40°F (4°C). Heating units shall be permanently installed.

[F] 902.1.4 Lighting. Permanently installed artificial illumination shall be provided in the *automatic sprinkler system* riser rooms and fire pump rooms.

SECTION 903
AUTOMATIC SPRINKLER SYSTEMS

[F] 903.1 General. *Automatic sprinkler systems* shall comply with this section.

[F] 903.1.1 Alternative protection. Alternative *automatic fire-extinguishing systems* complying with Section 904 shall be permitted instead of *automatic sprinkler systems* protection where recognized by the applicable standard and *approved* by the fire code official.

[W][S][F] 903.2 Where required. Approved *automatic sprinkler systems* in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12.

Exceptions:

1. ((~~Spaces~~)) Where allowed, spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an *automatic smoke detection system* in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or not less than 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.
2. Bottom of the elevator hoistway in an enclosed and noncombustible elevator shaft per Joint Administrative Ruling 9.06.14 and any future revisions.

[F] 903.2.1 Group A. An *automatic sprinkler system* shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section.

[F] 903.2.1.1 Group A-1. An *automatic sprinkler system* shall be provided throughout stories containing Group A-1 occupancies and throughout all stories from the Group A-1 occupancy to and including the *levels of exit discharge* serving that occupancy where one of the following conditions exists:

1. The *fire area* exceeds 12,000 square feet (1115 m^2).
2. The *fire area* has an *occupant load* of 300 or more.
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.
4. The *fire area* contains a multitheater complex.

[S][F] 903.2.1.2 Group A-2. An *automatic sprinkler system* shall be provided throughout stories containing Group A-2 occupancies and throughout all stories from the Group A-2 occupancy to and including the *levels of exit discharge* serving that occupancy where one of the following conditions exists:

1. The *fire area* exceeds 5,000 square feet (464 m^2).
2. The *fire area* has an *occupant load* of 100 or more.
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

   Exception: Item 3 does not apply to fire areas that include space located one floor above the level of exit discharge if the occupant load of the upper floor is less than 50.

[W][S][F] 903.2.1.3 Group A-3. An *automatic sprinkler system* shall be provided throughout stories containing Group A-3 occupancies and throughout all stories from the Group A-3 occupancy to and including the *levels of exit discharge* serving that occupancy where one of the following conditions exists:

1. The *fire area* exceeds 12,000 square feet (1115 m^2).
2. The *fire area* has an *occupant load* of 300 or more.
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

   Exceptions:

   1. Item 3 does not apply to fire areas that include space located one floor above the level of exit discharge if the occupant load of the upper floor is less than 50.
   2. For fixed guideway transit and passenger rail system stations, an automatic sprinkler system shall be provided in accordance with Section 3116.

[F] 903.2.1.4 Group A-4. An *automatic sprinkler system* shall be provided throughout stories containing Group A-4 occupancies and throughout all stories from the Group A-4 occupancy to and including the *levels of exit discharge* serving that occupancy where one of the following conditions exists:

1. The *fire area* exceeds 12,000 square feet (1115 m^2).
2. The *fire area* has an *occupant load* of 300 or more.
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

[F] 903.2.1.5 Group A-5. An *automatic sprinkler system* shall be provided for all enclosed Group A-5 accessory use areas in excess of 1,000 square feet (93 m^2).

[F] 903.2.1.5.1 Spaces under grandstands or bleachers. Enclosed spaces under *grandstands* or *bleachers* shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1 where either of the following exist:

1. The enclosed area is 1,000 square feet (93 m^2) or less and is not constructed in accordance with Section 1030.1.1.1.
2. The enclosed area exceeds 1,000 square feet (93 m^2).

[W][F] 903.2.1.6 Assembly occupancies on roofs. Where an occupied roof has an assembly occupancy with an *occupant load* exceeding 100 for Group A-2, and 300 for other Group A occupancies, ((~~all floors between the occupied roof and the *level of exit discharge*~~)) the *building* shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.

Exception: *Open parking garages* of Type I or Type II construction.

903.2.1.7 Multiple fire areas. An *automatic sprinkler system* shall be provided where multiple *fire areas* of Group A-1, A-2, A-3 or A-4 occupancies share *exit* or exit access components and the combined *occupant load* of theses *fire areas* is 300 or more.

[W] 903.2.1.8 Nightclubs. An *automatic sprinkler system* shall be provided throughout *nightclubs*.

[F] 903.2.2 Ambulatory care facilities. An *automatic sprinkler system* shall be installed throughout the entire floor containing an *ambulatory care facility* where either of the following conditions exist at any time:

1. Four or more care recipients are *incapable of self-preservation*.
2. One or more care recipients that are *incapable of self-preservation* are located at other than the *level of exit discharge* serving such a facility.

In buildings where ambulatory care is provided on levels other than the *level of exit discharge*, an *automatic sprinkler system* shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest *level of exit discharge*, the *level of exit discharge*, and all floors below the level of *exit discharge*.

Exception: Floors classified as an *open parking garage* are not required to be sprinklered.

[W][F] 903.2.3 Group E. An *automatic sprinkler system* shall be provided for fire areas containing Group E ((~~occupancies as follows:~~)) where the fire area has an occupant load of 51 or more, calculated in accordance with Table 1004.5.

((~~1. Throughout all Group E *fire areas* greater than 12,000 square feet (1115 m^2) in area.~~

~~2. The Group E *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.~~

~~**Exception:** In buildings where every classroom has not fewer than one exterior *exit* door at ground level, an *automatic sprinkler system* is not required in any area below the lowest *level of exit discharge* serving that area.~~

~~3. The Group E *fire area* has an *occupant load* of 300 or more.~~))

Exceptions:

1. *Portable school classrooms* with an occupant load of 50 or less calculated in accordance with Table 1004.5, provided that the aggregate area of any cluster of *portable school classrooms* does not exceed 6,000 square feet (557 m^2); and clusters of *portable school classrooms* shall be separated as required by the building code.
2. *Portable school classrooms* with an occupant load from 51 through 98, calculated in accordance with Table 1004.5, and provided with two means of direct independent exterior egress from each classroom in accordance with Chapter 10, and one exit from each classroom shall be accessible, provided that the aggregate area of any cluster of portable classrooms does not exceed 6,000 square feet (557 m^2), and clusters of *portable school classrooms* shall be separated as required by the building code.
3. Fire areas containing day care and preschool facilities with a total occupant load of 100 or less located at the level of exit discharge where every room in which care is provided has not fewer than one exit discharge door.

[F] 903.2.4 Group F-1. An *automatic sprinkler system* shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 *fire area* exceeds 12,000 square feet (1115 m^2).
2. A Group F-1 *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group F-1 *fire areas* on all floors, including any *mezzanines*, exceeds 24,000 square feet (2230 m^2).

[F] 903.2.4.1 Woodworking operations. An *automatic sprinkler system* shall be provided throughout all Group F-1 occupancy *fire areas* that contain woodworking operations in excess of 2,500 square feet (232 m^2) in area that generate finely divided combustible waste or use finely divided combustible materials.

[F] 903.2.4.2 Group F-1 distilled spirits. An *automatic sprinkler system* shall be provided throughout a Group F-1 *fire area* used for the manufacture of distilled spirits.

[F] 903.2.4.3 Group F-1 upholstered furniture or mattresses. An *automatic sprinkler system* shall be provided throughout a Group F-1 *fire area* that exceeds 2,500 square feet (232 m^2) used for the manufacture of upholstered furniture or mattresses.

[F] 903.2.5 Group H. *Automatic sprinkler systems* shall be provided in high-hazard occupancies as required in Sections 903.2.5.1 through 903.2.5.3.

[F] 903.2.5.1 General. An *automatic sprinkler system* shall be installed in Group H occupancies.

[F] 903.2.5.2 Group H-5 occupancies. An *automatic sprinkler system* shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall be not less than that required by this code for the occupancy hazard classifications in accordance with Table 903.2.5.2.

Where the design area of the sprinkler system consists of a *corridor* protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

[F] TABLE 903.2.5.2
GROUP H-5 SPRINKLER DESIGN CRITERIA

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

[F] 903.2.5.3 Pyroxylin plastics. An *automatic sprinkler system* shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

[W][S][F] 903.2.6 Group I. An *automatic sprinkler system* in accordance with Section 903.3.1.1 shall be provided throughout buildings with a Group I *fire area* as required in Sections 903.2.6 through 903.2.6.1.1.

Exceptions:

1. An *automatic sprinkler system* installed in accordance with Section 903.3.1.2 shall be permitted in Group I-1, Condition 1 facilities, when located in buildings that are within the scope of Section 903.3.1.2.

((~~2. An *automatic sprinkler system* is not required where Group I-4 day care facilities are at the *level of exit discharge* and where every room where care is provided has not fewer than one exterior exit door.~~

~~3. In buildings where Group I-4 day care is provided on levels other than the *level of exit discharge*, an *automatic sprinkler system* in accordance with Section 903.3.1.1 shall be installed on the entire floor where care is provided, all floors between the level of care and the *level of exit discharge*, and all floors below the *level of exit discharge* other than areas classified as an open parking garage.~~))

2. Where new construction or additions house less than 16 persons receiving care, an *automatic sprinkler system* installed in accordance with the scope of Section 903.3.1.2 shall be permitted for Group I-1, Condition 2, assisted living facilities licensed under chapter 388-78A WAC and residential treatment facilities licensed under chapter 246-337 WAC.
3. An automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be permitted in additions to existing buildings where both of the following situations are true:
   3.1. The addition is made to a building previously approved as Group LC or Group R-2 that houses either an assisted living facility licensed under chapter 388-78A WAC or residential treatment facility licensed under chapter 246-337 WAC.
   3.2. The addition contains spaces for 16 or fewer persons receiving care.

[W] 903.2.6.1 Group I-4. An automatic sprinkler system shall be provided in fire areas containing Group I-4 occupancies where the fire area has an occupant load of 51 or more, calculated in accordance with Table 1004.5.

Exception: An automatic sprinkler system is not required for Group I-4 day care facilities with a total occupant load of 100 or less, and located at the level of exit discharge and where every room where care is provided has not fewer than one exterior exit door.

903.2.6.1.1 Group I-4 daycare located other than level of discharge. In buildings where Group I-4 day care is provided on levels other than the level of exit discharge, an automatic sprinkler system in accordance with Section 903.3.1.1 shall be installed on the entire floor where care is provided, including the level of exit discharge, and all floors between the level of care and the level of exit discharge and all floors below the level of exit discharge other than areas classified as an open parking garage.

[F] 903.2.7 Group M. An *automatic sprinkler system* shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M *fire area* exceeds 12,000 square feet (1115 m^2).
2. A Group M *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group M *fire areas* on all floors, including any *mezzanines*, exceeds 24,000 square feet (2230 m^2).

[F] 903.2.7.1 High-piled storage. An *automatic sprinkler system* shall be provided in accordance with the *International Fire Code* in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

[F] 903.2.7.2 Group M upholstered furniture or mattresses. An *automatic sprinkler system* shall be provided throughout a Group M *fire area* where the area used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m^2).

[W][S][F] 903.2.8 Group R. An *automatic sprinkler system* installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R *fire area*.

Exception: Group R-1 if all of the following conditions apply:

1. The Group R *fire area* is no more than 500 square feet and is used for recreational use only.
2. The Group R fire area is on only one *story*.
3. The Group R fire area does not include a basement.
4. The Group R fire area is no closer than 30 feet from another structure.
5. Cooking is not allowed within the Group R fire area.
6. The Group R fire area has an occupant load of no more than eight.
7. A hand-held (portable) fire extinguisher is in every Group R fire area.

[F] 903.2.8.1 Group R-3. An *automatic sprinkler system* installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 occupancies.

[F] 903.2.8.2 Group R-4, Condition 1. An *automatic sprinkler system* installed in accordance with Section 903.3.1.3 shall be permitted in Group R-4, Condition 1 occupancies.

[F] 903.2.8.3 Group R-4, Condition 2. An *automatic sprinkler system* installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4, Condition 2 occupancies.

[F] 903.2.8.4 Care facilities. An *automatic sprinkler system* installed in accordance with Section 903.3.1.3 shall be permitted in care facilities with five or fewer individuals in a single-family dwelling.

[W] 903.2.8.5 Adult family home. An *adult family home* with a capacity of seven or eight that serves residents who require assistance during an evacuation must install an *automatic sprinkler system* that meets the requirements of NFPA 13D.

[S][F] 903.2.9 Group S-1. An *automatic sprinkler system* shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 *fire area* exceeds 12,000 square feet (1115 m^2).
2. A Group S-1 *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group S-1 *fire areas* on all floors, including any *mezzanines*, exceeds 24,000 square feet (2230 m^2).
4. A Group S-1 *fire area* used for the storage of commercial motor vehicles where the *fire area* exceeds 5,000 square feet (464 m^2).
5. A Group S-1 occupancy used for self-storage where the *fire area* exceeds 2,500 square feet (232 m^2).

[F] 903.2.9.1 ((~~Repair~~)) Major repair garages. An *automatic sprinkler system* shall be provided throughout all buildings used as *major repair garages* in accordance with Section 406, as shown:

1. Buildings having two or more *stories above grade plane*, including basements, with a *fire area* containing a *major repair garage* exceeding 10,000 square feet (929 m^2).
2. Buildings not more than one *story above grade plane*, with a *fire area* containing a *major repair garage* exceeding 12,000 square feet (1115 m^2).
3. Buildings with *major repair garages* servicing vehicles parked in basements.
4. A Group S-1 *fire area* used for the major repair of commercial motor vehicles where the *fire area* exceeds 5,000 square feet (464 m^2).

[F] 903.2.9.2 Bulk storage of tires. Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m^3) shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[S][F] 903.2.9.3 Group S-1 Distilled spirits or wine. An *automatic sprinkler system* shall be provided throughout a Group S-1 *fire area* used for the ((~~bulk~~)) storage of distilled spirits or wine.

[F] 903.2.9.4 Group S-1 upholstered furniture and mattresses. An *automatic sprinkler system* shall be provided throughout a Group S-1 *fire area* where the area used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).

Exception: Self-service storage facilities not greater than one story above grade plane where all storage spaces can be accessed directly from the exterior.

[F] 903.2.10 Group S-2 parking garages. An *automatic sprinkler system* shall be provided throughout buildings classified as parking garages where any of the following conditions exists:

1. Where the fire area of the enclosed parking garage in accordance with Section 406.6 exceeds 12,000 square feet (1115 m^2).
2. Where the enclosed parking garage in accordance with Section 406.6 is located beneath other groups.

   Exception: Enclosed parking garages located beneath Group R-3 occupancies.
3. Where the *fire area* of the *open parking garage* in accordance with Section 406.5 exceeds 48,000 square feet (4460 m^2).

[F] 903.2.10.1 Commercial parking garages. An *automatic sprinkler system* shall be provided throughout buildings used for storage of commercial motor vehicles where the *fire area* exceeds 5,000 square feet (464 m^2).

[S][F] 903.2.10.2 Mechanical-access enclosed parking garages. An *approved automatic sprinkler system* shall be provided throughout buildings used for the storage of motor vehicles in a *mechanical-access enclosed parking garage*. The portion of the building that contains the *mechanical-access enclosed parking garage* shall be protected with a specially engineered *automatic sprinkler system* designed by a *registered design professional*. Enclosed parking garages in high rises that have mechanical access shall increase the secondary water tank size per Administrative Rule 9.03.20, *Automatic Sprinkler and Standpipe Systems*, and any future revisions of this rule adopted by the *fire code official*.

[S] 903.2.10.3 Car-stacking equipment located in parking garages. The equipment footprint and immediate access area for car-stacking equipment shall be protected by a specially engineered automatic sprinkler system designed by a *registered design professional*, when the number of cars stacked vertically exceeds two. The design shall be supported by an engineered report complying with Section 104.8 or 104.10 submitted to the *fire code official*.

[W][F] 903.2.11 Specific building areas and hazards. In all occupancies other than Group U, an *automatic sprinkler system* shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through ((~~903.2.11.6~~)) 903.2.11.7.

[F] 903.2.11.1 Stories without openings. An *automatic sprinkler system* shall be installed throughout all stories, including basements, of all buildings where the floor area exceeds 1,500 square feet (139.4 m^2) and where the *story* does not comply with the following criteria for *exterior wall* openings:

1. Openings below grade that lead directly to ground level by an exterior *stairway* complying with Section 1011 or an outside *ramp* complying with Section 1012. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of *exterior wall* in the *story* on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm).
2. Openings entirely above the adjoining ground level totaling not less than 20 square feet (1.86 m^2) in each 50 linear feet (15 240 mm), or fraction thereof, of *exterior wall* in the *story* on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm). The height of the bottom of the clear opening shall not exceed 44 inches (1118 mm) measured from the floor.

[F] 903.2.11.1.1 Opening dimensions and access. Openings shall have a minimum dimension of not less than 30 inches (762 mm). Access to such openings shall be provided for the fire department from the exterior and shall not be obstructed in a manner such that fire fighting or rescue cannot be accomplished from the exterior.

[F] 903.2.11.1.2 Openings on one side only. Where openings in a *story* are provided on only one side and the opposite wall of such *story* is more than 75 feet (22 860 mm) from such openings, the *story* shall be equipped throughout with an *approved automatic sprinkler system*, or openings shall be provided on not fewer than two sides of the *story*.

[W][F] 903.2.11.1.3 Basements. Where any portion of a *basement* is located more than 75 feet (22 860 mm) from openings required by Section 903.2.11.1, or where new walls, partitions or other similar obstructions are installed that

((~~restrict the application of water from hose streams~~)) increase the exit access travel distance to more than 75 feet, the *basement* shall be equipped throughout with an *approved automatic sprinkler system*.

[F] 903.2.11.2 Rubbish and linen chutes. An *automatic sprinkler system* shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. *Access* to sprinklers in chutes shall be provided for servicing.

[F] 903.2.11.3 Buildings 55 feet or more in height. An *automatic sprinkler system* shall be installed throughout buildings that have one or more stories with an *occupant load* of 30 or more located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access, measured to the finished floor.

Exception: Occupancies in Group F-2.

[F] 903.2.11.4 Ducts conveying hazardous exhausts. Where required by the *International Mechanical Code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust or flammable or combustible materials.

Exception: Ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

[W][F] 903.2.11.5 Commercial cooking operations. An *automatic sprinkler system* shall be installed in commercial kitchen exhaust hood and duct systems where an *automatic sprinkler system* is used to comply with Section 904.

Exception: An *automatic fire sprinkler system* is not required to protect the ductwork that is in excess of 75 feet when the commercial kitchen exhaust hood is protected by a system listed per UL 300.

[F] 903.2.11.6 Other required fire protection systems. In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 require the installation of a fire protection system for certain buildings and areas.

[S][F] TABLE 903.2.11.6
ADDITIONAL REQUIRED FIRE PROTECTION SYSTEMS

SECTION	SUBJECT
322.4.2.3	Lithium-ion and lithium metal battery storage
402.5, 402.6.2	Covered and open mall buildings
403.3	High-rise buildings
404.3	Atriums
405.3	Underground structures
407.7	Group I-2
410.6	Stages
411.3	Special amusement buildings
412.2.4	Airport traffic control towers
412.3.6, 412.3.6.1, 412.5.6	Aircraft hangars
415.11.11	Group H-5 HPM exhaust ducts
416.5	Flammable finishes
417.4	Drying rooms
424.3	Play structures
428	Buildings containing laboratory suites
507	Unlimited area buildings
508.5.7	Live/work units
509.4	Incidental uses
1030.6.2.3	Smoke-protected assembly seating
IFC	Sprinkler system requirements as set forth in Section 903.2.11.6 of the *International Fire Code*

[W] 903.2.11.7 Relocatable buildings within buildings. Relocatable buildings or structures located within a building with an *approved* fire sprinkler system shall be provided with fire sprinkler protection within the occupiable space of the building and the space underneath the relocatable building.

Exceptions:

1. Sprinkler protection is not required underneath the building when the space is separated from the adjacent space by construction resisting the passage of smoke and heat and combustible storage will not be located there.
2. If the building or structure does not have a roof or ceiling obstructing the overhead sprinklers.
3. Construction trailers and temporary offices used during new building construction prior to occupancy.
4. Movable shopping mall kiosks with a roof or canopy dimension of less than 4 feet on the smallest side.

[[F] 903.2.12 During construction. *Automatic sprinkler systems* required during construction, alteration and demolition operations shall be provided in accordance with Chapter 33 of the *International Fire Code*.

[S] 903.2.13 Privacy booths and temporarily occupied small enclosures. Enclosures shall not be required to provide automatic fire sprinkler protection when the enclosure does not extend to within the horizontal plane 18 inches below the sprinkler deflector, the enclosure does not exceed 4 feet in length or width, and the enclosures are separated from building wall construction and other such enclosures by not less than 6 inches.

[F] 903.3 Installation requirements. *Automatic sprinkler systems* shall be designed and installed in accordance with Sections 903.3.1 through 903.3.8.

[S][F] 903.3.1 Standards. Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1 and rules promulgated by the *building official* or *fire code official* unless otherwise permitted by Sections 903.3.1.2 and 903.3.1.3 and other chapters of this code, as applicable.

[F] 903.3.1.1 NFPA 13 sprinkler systems. Where the provisions of this code require that a building or portion thereof be equipped throughout with an *automatic sprinkler system* in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Sections 903.3.1.1.1 and ((~~903.3.1.1.2~~)) 903.3.1.1.3.

[S][F] 903.3.1.1.1 Exempt locations. Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an *approved* automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from a room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.

1. A room where the application of water, or flame and water, constitutes a serious life or fire hazard, when approved by the *fire code official*.
2. A room or space where sprinklers are considered undesirable because of the nature of the contents, where *approved* by the fire code official.
3. ((~~Generator and transformer rooms~~)) Transformer vaults separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a *fire-resistance rating* of not less than ((~~2~~)) 3 hours.
4. Rooms or areas that are of noncombustible construction with wholly noncombustible contents.

((~~5. Fire service access elevator machine rooms and machinery spaces.~~

~~6~~)) 5. Machine rooms, machinery spaces, control rooms and control spaces ((~~associated with occupant evacuation elevators designed in accordance with Section 3008~~)) in accordance with rules promulgated by the *building official* and *fire code official*.

[F] 903.3.1.1.2 Bathrooms. In Group R occupancies sprinklers shall not be required in bathrooms that do not exceed 55 square feet (5 m^2) in area and are located within individual *dwelling units* or *sleeping units*, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating.

[S] 903.3.1.1.3 High-rise building sprinkler system design. High-rise building automatic fire sprinkler systems shall be combination standpipe/sprinkler systems incorporating the following features:

1. Each floor automatic fire sprinkler system shall be connected between standpipe risers.
2. Shut-off valves, water-flow devices and check valves (or pressure reducing valves) shall be provided on each floor at the sprinkler system connection to each standpipe.
3. Two four-way fire department connections serving the combination system shall be provided on separate streets well separated from each other per Section 912.2.3.
4. At least one of the fire department connections shall be connected to the riser above a riser isolation valve. At least one fire department connection shall be located on the address side of the building.
5. When a mid-level fire pump is required to meet pressure requirements, two pumps with the same rating shall be installed.

6. Dry-pipe sprinkler systems serving parking garages may use separate two-way fire department connection. The dry-pipe sprinkler system shall be supplied by the on-site water tank.
7. The standpipe risers in each required stair shall be a minimum pipe size of 6 inches (152 mm).
8. Two 2-1/2-inch (64 mm) hose connections shall be provided on every floor level landing in every required stairway. If pressure reducing valves (PRV) are required, each hose connection shall be provided with its own PRV.
9. The system shall be designed to provide a minimum flow of 300 gpm (19 L/s) at a minimum pressure of 150 psi (1034 kPa) [maximum 205 psi (1379 kPa)] at each standpipe connection in addition to the flow and pressure requirements contained in NFPA 14.

[W][F] 903.3.1.2 NFPA 13R sprinkler systems. *Automatic sprinkler systems* in Group R occupancies up to and including four stories in height in buildings not exceeding 60 feet (18 288 mm) in height above grade plane shall be permitted to be installed throughout in accordance with NFPA 13R. ((~~where the Group R occupancy meets all of the following conditions:~~

~~1. Four stories or fewer above *grade plane*.~~
~~2. The floor level of the highest *story* is 30 feet (9144 mm) or less above the lowest level of fire department vehicle access.~~
~~3. The floor level of the lowest *story* is 30 feet (9144 mm) or less below the lowest level of fire department vehicle access.~~))

The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 shall be measured from ((~~grade plane~~)) the horizontal assembly creating separate buildings.

[S][F] 903.3.1.2.1 Balconies and decks. Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of *dwelling units* and *sleeping units* in accordance with rules promulgated by the *building official* or *fire code official*. ((~~where~~)) Where either of the following conditions exists:

1. The building is of Type V construction, provided that there is a roof or deck above.
2. Exterior balconies, decks and ground floor patios of dwelling units and sleeping units are constructed in accordance with Section 705.2.3.1, Exception 3.

Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

[F] 903.3.1.2.2 *Corridors* and balconies in the means of egress. Sprinkler protection shall be provided in *corridors* and for balconies in the *means of egress* where any of the following conditions apply:

1. Corridors with combustible floor or walls.
2. Corridors with an interior change of direction exceeding 45 degrees (0.79 rad).
3. Corridors that are less than 50 percent open to the outside atmosphere at the ends.
4. Open-ended corridors and associated exterior stairways and ramps as specified in Section 1027.6, Exception 3.
5. Egress balconies not complying with Sections 1021.2 and 1021.3.

[F] 903.3.1.2.3 Attics. *Attic* protection shall be provided as follows:

1. *Attics* that are used or intended for living purposes or storage shall be protected by an *automatic sprinkler system*.
2. Where fuel-fired equipment is installed in an unsprinklered *attic*, not fewer than one quick-response intermediate temperature sprinkler shall be installed above the equipment.
3. Where located in a building of Type III, Type IV or Type V construction designed in accordance with Section 510.2 or 510.4, attics not required by Item 1 to have sprinklers shall comply with one of the following if the roof assembly is located more than 55 feet (16 764 mm) above the lowest level of fire department vehicle access needed to meet the provisions in Section 503.
    3.1. Provide *automatic sprinkler system* protection.
    3.2. Construct the *attic* using noncombustible materials.
    3.3. Construct the *attic* using *fire-retardant-treated wood* complying with Section 2303.2.
    3.4. Fill the *attic* with noncombustible insulation.

The height of the roof assembly shall be determined by measuring the distance from the lowest required fire vehicle access road surface adjacent to the building to the eave of the highest pitched roof, the intersection of the highest

roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. For the purpose of this measurement, required fire vehicle access roads shall include only those roads that are necessary for compliance with Section 503 of the *International Fire Code*:

4. Group R-4, Condition 2 occupancy *attics* not required by Item 1 to have sprinklers shall comply with one of the following:
   4.1. Provide *automatic sprinkler system* protection.
   4.2. Provide a heat detection system throughout the *attic* that is arranged to activate the building fire alarm system.
   4.3. Construct the *attic* using non-combustible materials.
   4.4. Construct the *attic* using *fire-retardant-treated wood* complying with Section 2303.2.
   4.5. Fill the *attic* with noncombustible insulation.

[S][F] 903.3.1.3 NFPA 13D sprinkler systems. *Automatic sprinkler systems* installed in one- and two-family *dwellings*; Group R-3; Group R-4, Condition 1; and *townhouses* three stories or less, or when approved by the *fire code official*, shall be permitted to be installed throughout in accordance with NFPA 13D.

[F] 903.3.2 Quick-response and residential sprinklers. Where *automatic sprinkler systems* are required by this code, quick-response or residential automatic sprinklers shall be installed in all of the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a *smoke compartment* containing care recipient *sleeping units* in Group I-2 in accordance with this code.
2. Throughout all spaces within a *smoke compartment* containing gas fireplace appliances and decorative gas appliances in Group I-2.
3. Throughout all spaces within a *smoke compartment* containing treatment rooms in *ambulatory care facilities*.
4. *Dwelling units* and *sleeping units* in Group I-1 and R occupancies.
5. Light-hazard occupancies as defined in NFPA 13.

[S][F] 903.3.3 Obstructed locations. Automatic sprinklers shall be installed ((~~with regard to obstructions that will delay activation or obstruct the water distribution pattern~~)) in accordance with NFPA 13 obstruction criteria and the listing requirements of the sprinkler and shall be in accordance with the applicable *automatic sprinkler system* standard that is being used. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width and depth. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of *combustible fibers*.

Exception: Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

[F] 903.3.4 Actuation. *Automatic sprinkler systems* shall be automatically actuated unless specifically provided for in this code.

[S][F] 903.3.5 Water supplies. Water supplies for *automatic sprinkler systems* shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with the requirements of this section and the ((~~*International*~~)) *Uniform Plumbing Code*. For connections to public waterworks systems, the water supply test report provided by Seattle Public Utilities and used for design of fire protection systems shall be adjusted ((~~to account for seasonal and daily pressure fluctuations based on information from the water supply authority and as approved by the fire code official~~)) in accordance with rules promulgated by the *fire code official*.

[S][F] 903.3.5.1 Domestic services. ((~~Where the domestic service provides the water supply for the *automatic sprinkler system*, the supply shall be~~)) Both NFPA 13R and NFPA 13D sprinkler systems can be supplied by a domestic service in accordance with this section.

[S][F] 903.3.5.2 ((~~Residential combination~~)) Combined fire/domestic services. A single combination water supply shall be allowed for all types of sprinkler systems provided that, when required by the applicable sprinkler standard, the domestic demand is added to the sprinkler demand ((~~as required by~~)) in accordance with the domestic demand tables in NFPA 13R.

[S] 903.3.5.3 Fire service. A fire service utility connection shall be allowed for all types of sprinkler piping.

[W][S] 903.3.5.4 Underground portions of fire protection system water supply piping. The installation or modification of an underground water main, public or private, supplying a water-based fire protection system shall be in accordance with NFPA 24 and RCW 18.160. Piping and appurtenances downstream of the first control valve on the lateral or service line from the distribution main to one foot above finished floor shall be approved by the *fire code official*. Such underground piping shall be installed by a fire sprinkler contractor licensed in accordance with chapter 18.160

RCW and holding either a Level U or a Level 3 license. For underground piping supplying systems installed in accordance with Section 903.3.1.2, a Level 2, 3, or U licensed contractor is acceptable.

Exceptions:

1. Portions of underground piping supplying automatic sprinkler systems installed in accordance with Section 903.3.1.3.
2. Portions of underground water mains serving sprinkler systems that are designed and installed in accordance with Section 903.3.1.2 and are less than four inches (100 mm) in nominal diameter.

[F] 903.3.6 Hose threads. Fire hose threads and fittings used in connection with *automatic sprinkler systems* shall be as prescribed by the fire code official.

[F] 903.3.7 Fire department connections. Fire department connections for *automatic sprinkler systems* shall be installed in accordance with Section 912.

[F] 903.3.8 Limited area sprinkler systems. Limited area sprinkler systems shall be in accordance with the standards listed in Section 903.3.1 except as provided in Sections 903.3.8.1 through 903.3.8.5.

903.3.8.1 Number of sprinklers. Limited area sprinkler systems shall not exceed six sprinklers in any single *fire area*.

903.3.8.2 Occupancy hazard classification. Only areas classified by NFPA 13 as Light Hazard or Ordinary Hazard Group 1 shall be permitted to be protected by limited area sprinkler systems.

903.3.8.3 Piping arrangement. Where a limited area sprinkler system is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system. Where a limited area sprinkler system is installed in a building without an automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system provided that the plumbing system is capable of simultaneously supplying domestic and sprinkler demands.

903.3.8.4 Supervision. Control valves shall not be installed between the water supply and sprinklers unless the valves are of an *approved* indicating type that are supervised or secured in the open position.

903.3.8.5 Calculations. Hydraulic calculations in accordance with NFPA 13 shall be provided to demonstrate that the available water flow and pressure are adequate to supply all sprinklers installed in any single *fire area* with discharge densities corresponding to the hazard classification.

[S][F] 903.4 Sprinkler system supervision and alarms. Valves controlling the water supply for *automatic sprinkler systems*, pumps, tanks, water levels and temperatures, critical air pressures and waterflow switches on all sprinkler systems shall be electrically supervised by a *listed* fire alarm control unit.

Exceptions:

1. *Automatic sprinkler systems* protecting one- and two-family *dwellings* and *townhouses* where each townhouse unit is provided with a dedicated sprinkler system, or if approved by the *fire code official*.
2. Limited area sprinkler systems in accordance with Section 903.3.8.
3. *Automatic sprinkler systems* installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the *automatic sprinkler system*, and a separate shutoff valve for the *automatic sprinkler system* is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.
5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.
6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.
8. ((~~Underground key or hub gate valves in roadway boxes.~~)) Valves provided by the municipality or public utility are not required to be monitored.

[F] 903.4.1 Monitoring. Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to an *approved* supervising station or, where *approved* by the fire code official, shall sound an audible signal at a *constantly attended location*.

Exception: Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

[F] 903.4.2 Alarms. An approved audible device, located on the exterior of the building in an approved location, shall be connected to each *automatic sprinkler system*. Such sprinkler waterflow alarm devices shall be activated by water flow

equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Where a fire alarm system is installed, actuation of the *automatic sprinkler system* shall actuate the building fire alarm system.

[F] 903.4.3 Floor control valves. *Approved* supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings.

[F] 903.5 Testing and maintenance. Automatic sprinkler systems shall be tested and maintained in accordance with the *International Fire Code*.

SECTION 904
ALTERNATIVE AUTOMATIC FIRE-EXTINGUISHING SYSTEMS

[F] 904.1 General. Automatic fire-extinguishing systems, other than *automatic sprinkler systems*, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.

[F] 904.2 Where permitted. Automatic fire-extinguishing systems installed as an alternative to the required *automatic sprinkler systems* of Section 903 shall be *approved* by the fire code official.

[F] 904.2.1 Restriction on using automatic sprinkler system exceptions or reductions. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed for *automatic sprinkler systems* or by other requirements of this code.

[F] 904.2.2 Commercial hood and duct systems. Each required commercial kitchen exhaust hood and duct system required by Section 606 of the *International Fire Code* or Chapter 5 of the *International Mechanical Code* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

[S][F] 904.3 Installation. Automatic fire-extinguishing systems shall be installed in accordance with this section.

[F] 904.3.1 Electrical wiring. Electrical wiring shall be in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[F] 904.3.2 Actuation. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.11.1. Where more than one hazard could be simultaneously involved in fire due to their proximity, all hazards shall be protected by a single system designed to protect all hazards that could become involved.

Exception: Multiple systems shall be permitted to be installed if they are designed to operate simultaneously.

[F] 904.3.3 System interlocking. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

[F] 904.3.4 Alarms and warning signs. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with Section 907.5.2.

[F] 904.3.5 Monitoring. Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.

[F] 904.4 Inspection and testing. Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

[F] 904.4.1 Inspection. Prior to conducting final acceptance tests, all of the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

[F] 904.4.2 Alarm testing. Notification appliances, connections to fire alarm systems and connections to *approved* supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

[F] 904.4.2.1 Audible and visible signals. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

[F] 904.4.3 Monitor testing. Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

[F] 904.5 Wet-chemical systems. Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17A and their listing. Records of inspections and testing shall be maintained.

[F] 904.6 Dry-chemical systems. Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17 and their listing. Records of inspections and testing shall be maintained.

[F] 904.7 Foam systems. Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 11 and NFPA 16 and their listing. Records of inspections and testing shall be maintained.

[F] 904.8 Carbon dioxide systems. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12 and their listing. Records of inspections and testing shall be maintained.

[F] 904.9 Halon systems. Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12A and their listing. Records of inspections and testing shall be maintained.

[F] 904.10 Clean-agent systems. Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 2001 and their listing. Records of inspections and testing shall be maintained.

[F] 904.11 Automatic water mist systems. *Automatic water mist systems* shall be permitted in applications that are consistent with the applicable listing or approvals and shall comply with Sections 904.11.1 through 904.11.3.

[F] 904.11.1 Design and installation requirements. *Automatic water mist systems* shall be designed and installed in accordance with Sections 904.11.1.1 through 904.11.1.4.

[F] 904.11.1.1 General. *Automatic water mist systems* shall be designed and installed in accordance with NFPA 750 and the manufacturer's instructions.

[F] 904.11.1.2 Actuation. *Automatic water mist systems* shall be automatically actuated.

[F] 904.11.1.3 Water supply protection. Connections to a potable water supply shall be protected against backflow in accordance with the *International Plumbing Code*.

[F] 904.11.1.4 Secondary water supply. Where a secondary water supply is required for an *automatic sprinkler system*, an *automatic water mist system* shall be provided with an *approved* secondary water supply.

[F] 904.11.2 Water mist system supervision and alarms. Supervision and alarms shall be provided as required for *automatic sprinkler systems* in accordance with Section 903.4.

[F] 904.11.2.1 Monitoring. Monitoring shall be provided as required for *automatic sprinkler systems* in accordance with Section 903.4.1.

[F] 904.11.2.2 Alarms. Alarms shall be provided as required for *automatic sprinkler systems* in accordance with Section 903.4.2.

[F] 904.11.2.3 Floor control valves. Floor control valves shall be provided as required for *automatic sprinkler systems* in accordance with Section 903.4.3.

[F] 904.11.3 Testing and maintenance. *Automatic water mist systems* shall be tested and maintained in accordance with the *International Fire Code*.

* ** **[F] 904.12 Aerosol fire-extinguishing systems.** Aerosol fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 2010, and their listing.

Such devices and appurtenances shall be listed and installed in compliance with manufacturers' instructions.

** **[W][S][F] 904.13 Commercial cooking systems.** The automatic fire-extinguishing system for commercial cooking systems shall be of a type recognized for protection of commercial cooking equipment and exhaust systems of the type and arrangement protected. Preengineered automatic dry- and wet-chemical extinguishing systems shall be tested in accordance with UL 300 and *listed* and *labeled* for the intended application. Other types of automatic fire-extinguishing systems shall be *listed* and *labeled* for specific use as protection for commercial cooking operations. The system shall be installed in accordance with this code, NFPA 96, its listing and the manufacturer's installation instructions. Additional protection is not required for ductwork beyond 75 feet when the hood suppression system complies with UL 300. Signage shall be provided on the exhaust hood or system cabinet, indicating the type and arrangement of cooking appliances protected by the automatic fire extinguishing system. Signage shall indicate appliances from left to right, be durable, and the size, color and lettering shall be approved. Automatic fire-extinguishing systems of the following types shall be installed in accordance with the referenced standard indicated, as follows:

1. Carbon dioxide extinguishing systems, NFPA 12.
2. *Automatic sprinkler systems*, NFPA 13.
3. Automatic water mist systems, NFPA 750.
4. Foam-water sprinkler system or foam-water spray systems, NFPA 16.
5. Dry-chemical extinguishing systems, NFPA 17.

6. Wet-chemical extinguishing systems, NFPA 17A.

Exceptions:

1. Factory-built commercial cooking recirculating systems that are tested in accordance with UL 710B and *listed*, *labeled* and installed in accordance with Section 304.1 of the *International Mechanical Code*.
2. Protection of duct systems beyond 75 feet when the commercial kitchen exhaust hood is protected by a system listed in accordance with UL 300.

[F] 904.13.1 Manual system operation. A manual actuation device shall be located at or near a *means of egress* from the cooking area not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) or less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

Exception: *Automatic sprinkler systems* shall not be required to be equipped with manual actuation means.

[F] 904.13.2 System interconnection. The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

[F] 904.13.3 Carbon dioxide systems. Where carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). *Dampers* shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the *damper* is installed at the top of the duct, the top nozzle shall be immediately below the *damper*. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

[F] 904.13.3.1 Ventilation system. Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

[F] 904.13.4 Special provisions for automatic sprinkler systems. *Automatic sprinkler systems* protecting commercial-type cooking equipment shall be supplied from a separate, indicating-type control valve that is identified. Access to the control valve shall be provided.

[F] 904.13.4.1 Listed sprinklers. Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, *listed* for that application and installed in accordance with their listing. *

[F] 904.14 Domestic cooking facilities. Cooktops and ranges installed in the following occupancies shall be protected in accordance with Section 904.14.1:

1. In Group I-1 occupancies where domestic cooking facilities are installed in accordance with Section 420.9.
2. In Group I-2 occupancies where domestic cooking facilities are installed in accordance with Section 407.2.7.
3. In Group R-2 college *dormitories* where domestic cooking facilities are installed in accordance with Section 420.11.

[F] 904.14.1 Protection from fire. Cooktops and ranges shall be protected in accordance with Section 904.14.1.1 or 904.14.1.2.

[F] 904.14.1.1 Automatic fire-extinguishing system. The domestic recirculating or exterior vented cooking hood provided over the cooktop or range shall be equipped with an approved automatic fire-extinguishing system complying with the following:

1. The automatic fire-extinguishing system shall be of a type recognized for protection of domestic cooking equipment. Preengineered automatic fire-extinguishing systems shall be listed and labeled in accordance with UL 300A and installed in accordance with the manufacturer's instructions.
2. Manual actuation of the fire-extinguishing system shall be provided in accordance with Section 904.13.1.
3. Interconnection of the fuel and electric power supply shall be in accordance with Section 904.13.2.

[F] 904.14.1.2 Ignition prevention. Cooktops and ranges shall include burners that have been tested and listed to prevent ignition of cooking oil with burners turned on to their maximum heat settings and allowed to operate for 30 minutes.

SECTION 905
STANDPIPE SYSTEMS

[F] 905.1 General. Standpipe systems shall be provided in new buildings and structures in accordance with Sections 905.2 through 905.11. In buildings used for high-piled combustible storage, fire protection shall be in accordance with the *International Fire Code*.

[S][F] 905.2 Installation standard. Standpipe systems shall be installed in accordance with this section, ((~~and~~)) NFPA 14 and rules promulgated by the building or *fire code official*. Fire department connections for standpipe systems shall be in accordance with Section 912.

[S][F] 905.3 Required installations. Standpipe systems shall be installed where required by Sections 905.3.1 through ((~~905.3.8~~)) 905.3.7. Standpipe systems are allowed to be combined with *automatic sprinkler systems*.

Exception: Standpipe systems are not required in ((~~Group R-3 occupancies~~)) one- and two-family *dwellings* and townhouses.

[F] 905.3.1 Height. Class III standpipe systems shall be installed throughout buildings where any of the following conditions exist:

1. Four or more stories are above or below *grade plane*.

((~~2. The floor level of the highest *story* is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access.~~

~~3~~)) 2. The floor level of the lowest *story* is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.

Exceptions:

1. Class I standpipes are allowed in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Class I standpipes are allowed in Group B and E occupancies.
3. Class I standpipes are allowed in parking garages.
4. Class I standpipes are allowed in basements equipped throughout with an *automatic sprinkler system*.
5. Class I standpipes are allowed in buildings where occupant-use hose lines will not be utilized by trained personnel or the fire department.
6. In determining the lowest level of fire department vehicle access, it shall not be required to consider either of the following:
   6.1. Recessed loading docks for four vehicles or less.
   6.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

[F] 905.3.2 Group A. Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an *occupant load* exceeding 1,000 persons.

Exceptions:

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings that are not high-rise buildings.

[S][F] 905.3.3 Covered and open mall buildings. Covered mall and *open mall buildings* shall be equipped throughout with a Class I standpipe system ((~~where required by Section 905.3.1. Mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped with Class I hose connections connected to the *automatic sprinkler system* sized to deliver water at 250 gallons per minute (946.4 L/min) at the hydraulically most remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed to not exceed a 50 pounds per square inch (psi) (345 kPa) residual pressure loss with a flow of 250 gallons per minute (946.4 L/min) from the fire department connection to the hydraulically most remote hose connection. Hose~~)) with hose connections ((~~shall be~~)) provided at each of the following locations:

1. Within the mall at the entrance to each *exit passageway* or *corridor*.
2. At each floor-level landing within *interior exit stairways* opening directly on the mall.
3. At exterior public entrances to the mall of a *covered mall building*.
4. At public entrances at the perimeter line of an *open mall building*.
5. At other locations as necessary so that the distance to reach all portions of a tenant space does not exceed 200 feet (60 960 mm) from a hose connection.

((~~**[F] 905.3.4 Stages.** *Stages* greater than 1,000 square feet in area (93 m^2) shall be equipped with a Class III wet standpipe system with 1-1/2-inch and 2-1/2-inch (38 mm and 64 mm) hose connections on each side of the stage.~~

~~**Exception:** Where the building or area is equipped throughout with an *automatic sprinkler system*, a 1-1/2-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.~~

~~**[F] 905.3.4.1 Hose and cabinet.** The 1-1/2-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1-1/2-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an *approved* adjustable fog nozzle and be mounted in a cabinet or on a rack.~~))

[F] ((~~905.3.5~~)) 905.3.4 Underground buildings. Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

[F] ((~~905.3.6~~)) 905.3.5 Helistops and heliports. Buildings with a rooftop *helistop* or *heliport* shall be equipped with a Class I or III standpipe system extended to the roof level on which the *helistop* or *heliport* is located in accordance with Section 2007.5 of the *International Fire Code*.

[F] ((~~905.3.7~~)) 905.3.6 Marinas and boatyards. Standpipes in marinas and boatyards shall comply with Chapter 36 of the *International Fire Code*.

[S][F] ((~~905.3.8~~)) 905.3.7 Landscaped roofs. Buildings or structures that have landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the landscaped roof is located.

Exception: The standpipe system shall not be required to be extended when in compliance with subsection 905.4(6).

[S][F] 905.4 Location of Class I standpipe hose connections. Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required ((~~*interior*~~)) *exit stairway*, a hose connection shall be provided for each story above and below *grade plane*. Hose connections shall be located at the main floor landing or intermediate landing throughout the building, unless otherwise *approved* by the fire code official.

   Exception: A single hose connection shall be permitted to be installed in the open corridor or open breezeway between open *stairs* that are not greater than 75 feet (22 860 mm) apart.

2. On each side of the wall adjacent to the exit opening of a *horizontal exit*.

   Exception: Where floor areas adjacent to a *horizontal exit* are reachable from an *interior exit stairway* hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the *horizontal exit*.

3. In every *exit passageway*, at the entrance from the *exit passageway* to other areas of a building.

   Exception: Where floor areas adjacent to an *exit passageway* are reachable from an *interior exit stairway* hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the entrance from the *exit passageway* to other areas of the building.

4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit *passageway* or exit *corridor* to the mall. In *open mall buildings*, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit *passageway* or *exit* corridor to the mall.

5. Where the roof has a slope less than 4 units vertical in 12 units horizontal (33.3-percent slope), a hose connection shall be located to serve the roof or at the highest landing of an *interior exit stairway* with access to the roof provided in accordance with Section 1011.12. Hose connections on a roof shall be at least 10 feet (3048 mm) from the roof edge, skylight, light well or other opening, unless protected by an *approved* 42-inch-high (1067 mm) guard or equivalent.

6. Where the most remote portion of a nonsprinklered floor or *story* is more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or *story* or roof is more than 200 feet (60 960 mm) from a hose connection, the fire code official is authorized to require that additional hose connections be provided in *approved* locations.

[F] 905.4.1 Protection. Risers and laterals of Class I standpipe systems not located within an *interior exit stairway* shall be protected by a degree of *fire resistance* equal to that required for vertical enclosures in the building in which they are located.

Exception: In buildings equipped throughout with an *approved automatic sprinkler system*, laterals that are not located within an *interior exit stairway* are not required to be enclosed within fire-resistance-rated construction.

[F] 905.4.2 Interconnection. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

[S][F] 905.5 Location of Class II standpipe hose connections. Class II standpipe hose connections located so that all portions of the building are within 30 feet (9144 mm) of a nozzle attached to 100 feet (30 480 mm) of hose. Class II standpipe hose connections shall be located where they will have *ready access*.

~~((**[F] 905.5.1 Groups A-1 and A-2.** In Group A-1 and A-2 occupancies having *occupant loads* exceeding 1,000 persons, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.~~))

[F] ((~~905.5.2~~)) 905.5.1 Protection. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

[F] ((~~905.5.3~~)) 905.5.2 Class II system 1-inch hose. A minimum 1-inch (25 mm) hose shall be allowed to be used for hose stations in light-hazard occupancies where investigated and *listed* for this service and where *approved* by the fire code official.

[F] 905.6 Location of Class III standpipe hose connections. Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

[F] 905.6.1 Protection. Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

[F] 905.6.2 Interconnection. In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

[F] 905.7 Cabinets. Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

[F] 905.7.1 Cabinet equipment identification. Cabinets shall be identified in an *approved* manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

Exceptions:

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an *approved* visual identification clear glass panel or a complete glass door panel are not required to be marked.

[F] 905.7.2 Locking cabinet doors. Cabinets shall be unlocked.

Exceptions:

1. Visual identification panels of glass or other *approved* transparent frangible material that is easily broken and allows access.
2. *Approved* locking arrangements.
3. Group I-3 occupancies.

[F] 905.8 Dry standpipes. Dry standpipes shall not be installed.

Exception: Where subject to freezing and in accordance with NFPA 14.

[S][F] 905.9 Valve supervision. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall be transmitted to the control unit.

Exceptions:

1. Valves ((~~to underground key or hub valves in roadway boxes~~)) do not require supervision.
2. Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system or *approved* supervising station.

[F] 905.10 During construction. Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3311.

[S][F] 905.11 Locking standpipe outlet caps. The *fire code official* is authorized to require locking caps on the outlets on standpipes where the responding fire department carries key wrenches for the removal that are compatible with locking Fire Department Connection (FDC) connection caps.

SECTION 906
PORTABLE FIRE EXTINGUISHERS

[S][F] 906.1 Where required. Portable fire extinguishers shall be installed in all of the following locations:

1. In Group A, B, E, F, H, I, M, R-1, R-2, R-4 and S occupancies.

Exceptions:

1. In Group R-2 occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each dwelling unit is provided with a portable fire extinguisher having a minimum rating of 1-A:10-B:C.
2. In Group E occupancies. portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each classroom is provided with a portable fire extinguisher having a minimum rating of 2-A:20-B:C.
3. In storage areas of Group S Occupancies where forklift, powered industrial truck or powered cart operators are the primary occupants, fixed extinguishers, as specified in NFPA 10, shall not be required where in accordance with all of the following:
    3.1. Use of vehicle-mounted extinguishers shall be approved by the fire code official.
    3.2. Each vehicle shall be equipped with a 10-pound, ((~~40A:80B:C~~)) 4A:80B:C extinguisher affixed to the vehicle using a mounting bracket approved by the extinguisher manufacturer or the fire code official for vehicular use.
    3.3. Not less than two spare extinguishers of equal or greater rating shall be available on site to replace a discharged extinguisher.
    3.4. Vehicle operators shall be trained in the proper operation, use and inspection of extinguishers.
    3.5. Inspections of vehicle-mounted extinguishers shall be performed daily.

2. Within 30 feet (9144 mm) distance of travel from commercial cooking equipment and from domestic cooking equipment in Group I-1; I-2, Condition 1; and R-2 college *dormitory* occupancies.
3. In areas where flammable or *combustible liquids* are stored, used or dispensed.
4. On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 3315.1 of the *International Fire Code*.
5. Where required by the *International Fire Code* sections indicated in Table 906.1.
6. Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the fire code official.

Exception: Portable fire extinguishers are not required at normally unmanned Group U occupancy buildings or structures where a portable fire extinguisher suitable to the hazard of the location is provided on the vehicle of visiting personnel.

[S][F] TABLE 906.1
ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS IN THE INTERNATIONAL FIRE CODE

IFC SECTION	SUBJECT
303.5	Asphalt kettles
307.5	Open burning
308.1.3	Open flames—torches
309.4	Powered industrial trucks
1204.10	Portable Generators
2005.2	Aircraft towing vehicles
2005.3	Aircraft welding apparatus
2005.4	Aircraft fuel-servicing tank vehicles
2005.5	Aircraft hydrant fuel-servicing vehicles
2005.6	Aircraft fuel-dispensing stations
2007.7	Heliports and helistops
2108.4	Dry cleaning plants
2305.5	Motor fuel-dispensing facilities
2310.6.4	Marine motor fuel-dispensing facilities
2311.6	Repair garages
2404.4.1	Spray-finishing operations
2405.4.2	Dip-tank operations
2406.4.2	Powder-coating areas
2804.3	Lumberyards/woodworking facilities
2808.8	Recycling facilities
2809.5	Exterior lumber storage

[S][F] TABLE 906.1—continued
ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS IN THE INTERNATIONAL FIRE CODE

IFC SECTION	SUBJECT
2903.5	Organic-coating areas
3006.3	Industrial ovens
3107.9	Tents and membrane structures
3206.10	High-piled storage
3305.10.2	Fire extinguishers for roofing operations
3306.6	Portable fire extinguishers
((~~3315.1~~	~~Buildings under construction or demolition~~))
((~~3318.3~~	~~Roofing operations~~))
3408.2	Tire rebuilding/storage
3504.2.6	Welding and other hot work
3604.4	Marinas
3703.6	Combustible fibers
5703.2.1	Flammable and combustible liquids, general
5704.3.3.1	Indoor storage of flammable and combustible liquids
5704.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
5705.4.9	Solvent distillation units
5706.2.7	Farms and construction sites—flammable and combustible liquids storage
5706.4.10.1	Bulk plants and terminals for flammable and combustible liquids
5706.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
5706.6.4	Tank vehicles for flammable and combustible liquids
5906.5.7	Flammable solids
6108.2	LP-gas

[F] 906.2 General requirements. Portable fire extinguishers shall be selected and installed in accordance with this section and NFPA 10.

Exceptions:

1. The distance of travel to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.
2. In Group I-3, portable fire extinguishers shall be permitted to be located at staff locations.

[F] 906.3 Size and distribution. The size and distribution of portable fire extinguishers shall be in accordance with Sections 906.3.1 through 906.3.4.

[F] TABLE 906.3(1)
FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS

	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum-rated single extinguisher	2-A[c]	2-A	4-A[a]
Maximum floor area per unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum floor area for extinguisher[b]	11,250 square feet	11,250 square feet	11,250 square feet
Maximum distance of travel to extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L.

a. Two 2-1/2-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.

b. Annex E.3.3 of NFPA 10 provides more details concerning application of the maximum floor area criteria.

c. Two water-type extinguishers each with a 1-A rating shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

[F] TABLE 906.3(2)
FIRE EXTINGUISHERS FOR FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH DEPTHS LESS THAN OR EQUAL TO 0.25 INCH[a]

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS (feet)
Light (Low)	5-B	30
	10-B	50
Ordinary (Moderate)	10-B	30
	20-B	50

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS (feet)
Extra (High)	40-B	30
	80-B	50

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. For requirements on water-soluble flammable liquids and alternative sizing criteria, see Section 5.5 of NFPA 10.

[F] 906.3.1 Class A fire hazards. The minimum sizes and distribution of portable fire extinguishers for occupancies that involve primarily Class A fire hazards shall comply with Table 906.3(1).

[F] 906.3.2 Class B fire hazards. Portable fire extinguishers for occupancies involving flammable or combustible liquids with depths less than or equal to 0.25-inch (6.4 mm) shall be selected and placed in accordance with Table 906.3(2).

Portable fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.4 mm) shall be selected and placed in accordance with NFPA 10.

[F] 906.3.3 Class C fire hazards. Portable fire extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or B hazard.

[F] 906.3.4 Class D fire hazards. Portable fire extinguishers for occupancies involving combustible metals shall be selected and placed in accordance with NFPA 10.

[F] 906.4 Cooking equipment fires. Fire extinguishers provided for the protection of cooking equipment shall be of an *approved* type compatible with the automatic fire-extinguishing system agent. Cooking equipment involving solid fuels or vegetable or animal oils and fats shall be protected by a Class K-rated portable extinguisher in accordance with Sections 906.1, Item 2, 906.4.1 and 906.4.2 of the *International Fire Code*, as applicable.

[F] 906.5 Conspicuous location. Portable fire extinguishers shall be located in conspicuous locations where they will have *ready access* and be immediately available for use. These locations shall be along normal paths of travel, unless the fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.

[F] 906.6 Unobstructed and unobscured. Portable fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.

[F] 906.7 Hangers and brackets. Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer's installation instructions.

[F] 906.8 Cabinets. Cabinets used to house portable fire extinguishers shall not be locked.

Exceptions:

1. Where portable fire extinguishers subject to malicious use or damage are provided with a means of ready access.
2. In Group I-3 occupancies and in mental health areas in Group I-2 occupancies, access to portable fire extinguishers shall be permitted to be locked or to be located in staff locations provided that the staff has keys.

[F] 906.9 Extinguisher installation. The installation of portable fire extinguishers shall be in accordance with Sections 906.9.1 through 906.9.3.

[F] 906.9.1 Extinguishers weighing 40 pounds or less. Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 5 feet (1524 mm) above the floor.

[F] 906.9.2 Extinguishers weighing more than 40 pounds. Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 3.5 feet (1067 mm) above the floor.

[F] 906.9.3 Floor clearance. The clearance between the floor and the bottom of installed hand-held portable fire extinguishers shall be not less than 4 inches (102 mm).

[F] 906.10 Wheeled units. Wheeled fire extinguishers shall be conspicuously located in a designated location.

SECTION 907
FIRE ALARM AND DETECTION SYSTEMS

[S][F] 907.1 General. This section covers the application, installation, performance and maintenance of fire alarm systems and their components. The requirements of Section 907.2 are applicable to new buildings and structures. The requirements of Section 907.9 are applicable to existing buildings and structures.

[S][F] 907.1.1 Construction documents. *Construction documents* for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code, the ((~~*International*~~)) *Seattle Fire Code* and NFPA 72; and relevant laws, ordinances, rules and regulations, as deter-

mined by the fire code official. The construction documents shall include but not be limited to the items, where applicable, listed in Sections 7.2, 7.4.1 through 7.4.10, and 18.4.1.5.4 of NFPA 72. Emergency voice/alarm communication system construction documents shall also indicate acoustically distinguished spaces per Section 907.5.2.2.6.

[S][F] 907.1.2 Fire alarm shop drawings. All *construction documents* shall be reviewed by a NICET III or IV in fire alarms, an ESA/NTS Certified Fire Alarm Designer (CFAD) Level III Fire in fire alarms or a professional engineer licensed in the state of Washington prior to being submitted for permitting. The reviewing professional shall submit a stamped, signed and dated letter; or a verification method approved by the *fire code official* indicating the system has been reviewed and meets or exceeds the design requirements of the state of Washington and the *fire code official*.

((~~Shop drawings for fire alarm systems shall be prepared in accordance with NFPA 72 and submitted for review and approval prior to system installation.~~))

[F] 907.1.3 Equipment. Systems and components shall be *listed* and *approved* for the purpose for which they are installed.

[F] 907.2 Where required—new buildings and structures. An *approved* fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code.

Not fewer than one manual fire alarm box shall be provided in an *approved* location to initiate a fire *alarm signal* for fire alarm systems employing automatic fire detectors or waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers, a single fire alarm box shall be installed.

Exceptions:

1. The manual fire alarm box is not required for fire alarm systems dedicated to elevator recall control and supervisory service.
2. The manual fire alarm box is not required for Group R-2 occupancies unless required by the *fire code official* to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event. Where provided, the manual fire alarm box shall not be located in an area that is open to the public.

[F] 907.2.1 Group A. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the *occupant load* due to the assembly occupancy is 300 or more, or where the Group A *occupant load* is more than 100 persons above or below the *lowest level of exit discharge*. Group A occupancies not separated from one another in accordance with Section 707.3.10 shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more. Activation of the fire alarm in Group A occupancies with an *occupant load* of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2.

Exception: Where *approved*, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an *approved, constantly attended location*.

[F] 907.2.1.2 Emergency voice/alarm communication captions. Stadiums, arenas and *grandstands* required to caption audible public announcements shall be in accordance with Section 907.5.2.2.4.

[F] 907.2.2 Group B. A manual fire alarm system, which activates the occupant notification system in accordance with Section 907.5, shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B *occupant load* of all floors is 500 or more.
2. The Group B *occupant load* is more than 100 persons above or below the lowest *level of exit discharge*.
3. The *fire area* contains an *ambulatory care facility*.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.2.1 Ambulatory care facilities. *Fire areas* containing *ambulatory care facilities* shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in *public use areas* outside of tenant spaces, including public *corridors* and elevator lobbies.

Exception: Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, provided that the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

[W][F] 907.2.3 Group E. ((~~A manual fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies. Where *automatic sprinkler systems* or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.~~)) Group E occupancies shall be provided with a manual fire alarm system that initiates the occupant notification signal utilizing one of the following:

1. An emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6; or
2. A system developed as part of a safe school plan adopted in accordance with RCW 28A.320.125 or developed as part of an emergency response system consistent with the provisions of RCW 28A.320.126. The system must achieve all of the following performance standards:
   - 2.1 The ability to broadcast voice messages or customized announcements;
   - 2.2 Includes a feature for multiple sounds, including sounds to initiate a lock down;
   - 2.3 The ability to deliver messages to the interior of a building, areas outside of a building as designated pursuant to the safe school plan, and to personnel;
   - 2.4 The ability for two-way communications;
   - 2.5 The ability for individual room calling;
   - 2.6 The ability for a manual override;
   - 2.7 Installation in accordance with NFPA 72;
   - 2.8 Provide 15 minutes of battery backup for alarm and 24 hours of battery backup for standby; and
   - 2.9 Includes a program for annual inspection and maintenance in accordance with NFPA 72.

Exceptions:

1. A manual fire alarm system shall not be required in Group E occupancies with an *occupant load* of 50 or less.
2. Emergency voice/alarm communication systems meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall not be required in Group E occupancies with *occupant loads* of 100 or less, provided that activation of the manual fire alarm system initiates an *approved* occupant notification signal in accordance with Section 907.5.
3. Where an existing approved alarm system is in place, an emergency voice/alarm system is not required in any portion of an existing Group E building undergoing any one of the following repairs, alteration or addition:
   - 3.1. Alteration or repair to an existing building including, without limitation, alterations to rooms and systems, and/or corridor configurations, not exceeding 35 percent of the fire area of the building (or the fire area undergoing the alteration or repair if the building is comprised of two or more fire areas); or
   - 3.2. An addition to an existing building, not exceeding 35 percent of the fire area of the building (or the fire area to which the addition is made if the building is comprised of two or more fire areas).

((~~3~~)) 4. Manual fire alarm boxes shall not be required in Group E occupancies where all of the following apply:

- ((~~3.1~~)) 4.1. Interior *corridors* are protected by smoke detectors.
- ((~~3.2~~)) 4.2. Auditoriums, cafeterias, gymnasiums and similar areas are protected by *heat detectors* or other *approved* detection devices.
- ((~~3.3~~)) 4.3. Shops and laboratories involving dusts or vapors are protected by *heat detectors* or other *approved* detection devices.
- ((~~3.4 Manual activation is provided from a normally occupied location.~~))

((~~4~~)) 5. Manual fire alarm boxes shall not be required in Group E occupancies where all of the following apply:

- ((~~4.1~~)) 5.1. The building is equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1.
- ((~~4.2~~)) 5.2. The emergency voice/alarm communication system will activate on sprinkler waterflow.
- ((~~4.3~~)) 5.3. Manual activation is provided from a normally occupied location.

[W][F] 907.2.3.1 Sprinkler systems or detection. When *automatic sprinkler systems* or *smoke detectors* are installed, such systems or detectors shall be connected to the *building fire alarm system*.

[F] 907.2.4 Group F. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

1. The Group F occupancy is two or more *stories* in height.
2. The Group F occupancy has a combined *occupant load* of 500 or more above or below the lowest *level of exit discharge*.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.5 Group H. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for *highly toxic* gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the *International Fire Code*.

[S][F] 907.2.6 Group I. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2, 907.2.6.4, and 907.2.6.3.3.

Exceptions:

1. Manual fire alarm boxes in sleeping units of Group I-1 and I-2 occupancies shall not be required at *exits* if located at all care providers' control stations or other constantly attended staff locations, provided that such manual fire alarm boxes are visible and provided with *ready access*, and the distances of travel required in Section 907.4.2.1 are not exceeded.
2. Occupant notification systems are not required to be activated where private mode signaling installed in accordance with NFPA 72 is *approved* by the fire code official and staff evacuation responsibilities are included in the fire safety and evacuation plan required by Section 404 of the *International Fire Code*.

[S][F] 907.2.6.1 Group I-1. In Group I-1 occupancies, an automatic smoke detection system shall be installed in *corridors*, waiting areas open to corridors and *habitable spaces* other than *sleeping units* and kitchens. The system shall be activated in accordance with Section ((~~907.5~~)) 907.4.

Exceptions:

1. For Group I-1, Condition 1 occupancies, smoke detection in *habitable spaces* is not required where the facility is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.
2. Smoke detection is not required for exterior balconies.

[F] 907.2.6.1.1 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

[F] 907.2.6.2 Group I-2. An automatic smoke detection system shall be installed in *corridors* in Group I-2, Condition 1 facilities and spaces permitted to be open to the corridors by Section 407.2. The system shall be activated in accordance with Section 907.4. Group I-2, Condition 2 occupancies shall be equipped with an automatic smoke detection system as required in Section 407.

Exceptions:

1. Corridor smoke detection is not required in *smoke compartments* that contain sleeping units where such units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each sleeping unit and shall provide an audible and visual alarm at the care providers' station attending each unit.
2. Corridor smoke detection is not required in *smoke compartments* that contain sleeping units where sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

[F] 907.2.6.3 Group I-3 occupancies. Group I-3 occupancies shall be equipped with a manual fire alarm system and automatic smoke detection system installed for alerting staff.

[F] 907.2.6.3.1 System initiation. Actuation of an automatic fire-extinguishing system, *automatic sprinkler system*, a manual fire alarm box or a fire detector shall initiate an approved fire *alarm signal* that automatically notifies staff.

[F] 907.2.6.3.2 Manual fire alarm boxes. Manual fire alarm boxes are not required to be located in accordance with Section 907.4.2 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

[F] 907.2.6.3.2.1 Manual fire alarm boxes in detainee areas. Manual fire alarm boxes are allowed to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

[F] 907.2.6.3.3 Automatic smoke detection system. An automatic smoke detection system shall be installed throughout resident housing areas, including *sleeping units* and contiguous day rooms, group activity spaces and other common spaces normally open to residents.

Exceptions:

1. Other *approved* smoke detection arrangements providing equivalent protection, including, but not limited to, placing detectors in exhaust ducts from cells or behind protective guards *listed* for the purpose, are allowed where necessary to prevent damage or tampering.
2. *Sleeping units* in Use Conditions 2 and 3 as described in Section 308.
3. Smoke detectors are not required in *sleeping units* with four or fewer occupants in *smoke compartments* that are equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.

[W] 907.2.6.4 Group I-4 occupancies. A manual *fire alarm system* that initiates the occupant notification signal using an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group I-4 occupancies. When *automatic sprinkler systems* or smoke detectors are installed, such systems or detectors shall be connected to the building *fire alarm system*.

Exceptions:

1. A manual fire alarm system is not required in Group I-4 occupancies with an occupant load of 50 or less.
2. Emergency voice alarm communication systems meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall not be required in Group I-4 occupancies with occupant loads of 100 or less, provided that activation of the manual fire alarm system initiates an approved occupant notification signal in accordance with Section 907.5.

[F] 907.2.7 Group M. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:

1. The combined Group M *occupant load* of all floors is 500 or more persons.
2. The Group M *occupant load* is more than 100 persons above or below the lowest *level of exit discharge*.

Exceptions:

1. A manual fire alarm system is not required in *covered or open mall buildings* complying with Section 402.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 and the occupant notification appliances will automatically activate throughout the notification zones upon sprinkler water flow.

[S] ((~~[F] 907.2.7.1 Occupant notification.~~ ~~During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a waterflow switch shall not be required to activate the alarm notification appliances when an *alarm signal* is activated at a *constantly attended location* from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.~~))

[F] 907.2.8 Group R-1. Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

[F] 907.2.8.1 Manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R- 1 occupancies.

Exceptions:

1. A manual fire alarm system is not required in buildings not more than two *stories* in height where all individual *sleeping units* and contiguous *attic* and crawl spaces to those units are separated from each other and public or common areas by not less than 1-hour *fire partitions* and each individual *sleeping unit* has an *exit* directly to a *public way, egress court* or *yard*.
2. Manual fire alarm boxes are not required throughout the building where all of the following conditions are met:

2.1. The building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.

2.2. The notification appliances will activate upon sprinkler water flow.

2.3. Not fewer than one manual fire alarm box is installed at an *approved* location.

[S][F] 907.2.8.2 Automatic ((~~smoke~~)) detection system. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed throughout all interior *corridors* serving *sleeping units*. Automatic heat detectors shall be provided in any non-sprinklered interior areas outside guestrooms other than *attics* and crawl spaces.

Exception: An automatic smoke detection system is not required in buildings that do not have interior *corridors* serving *sleeping units* and where each *sleeping unit* has a *means of egress* door opening directly to an *exit* or to an exterior *exit access* that leads directly to an *exit*.

Note: Smoke detectors may be required throughout corridors in accordance with Seattle Mechanical Code Section 606.2, depending on design details of the mechanical systems.

[F] 907.2.8.3 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

[F] 907.2.9 Group R-2. Fire alarm systems and smoke alarms shall be installed in Group R-2 occupancies as required in Sections 907.2.9.1 through 907.2.9.3.

[S][F] 907.2.9.1 Manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies where any of the following conditions apply:

1. Any *dwelling unit* or *sleeping unit* is located three or more *stories* above the lowest *level of exit discharge*.
2. Any *dwelling unit* or *sleeping unit* is located more than one *story* below the highest *level of exit discharge* of *exits* serving the *dwelling unit* or *sleeping unit*.
3. The building contains more than 16 *dwelling units* or *sleeping units*.

Exceptions:

1. A fire alarm system is not required in buildings not more than two stories in height where all *dwelling units* or *sleeping units* and contiguous *attic* and crawl spaces are separated from each other and public or common areas by not less than 1-hour *fire partitions* and each *dwelling unit* or *sleeping unit* has an *exit* directly to a *public way, egress court* or *yard*.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2 and the occupant notification appliances will automatically activate throughout the notification zones upon a sprinkler water flow.
3. A fire alarm system is not required in buildings that do not have interior *corridors* serving dwelling units and are protected by an approved *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that *dwelling units* either have a *means of egress* door opening directly to an exterior *exit access* that leads directly to the exits or are served by open-ended *corridors* designed in accordance with Section 1027.6, Exception 3.
4. A fire alarm system is not required in townhouses where each townhouse unit is provided with a dedicated sprinkler system or *approved* by the *fire code official*.
5. In boarding homes licensed by the state of Washington, manual fire alarm boxes in resident sleeping areas are not required at exits if located at all constantly attended staff locations if such staff locations are visible, continuously accessible, located on each floor, and positioned so no portion of the *story* exceeds a horizontal travel distance of 200 feet to a manual fire alarm box.

[F] 907.2.9.2 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

[F] 907.2.9.3 Group R-2 college and university buildings. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies operated by a college or university for student or staff housing in all of the following locations:

1. Common spaces outside of *dwelling units* and *sleeping units*.
2. Laundry rooms, mechanical equipment rooms and storage rooms.
3. All interior *corridors* serving *sleeping units* or *dwelling units*.

Exception: An automatic smoke detection system is not required in buildings that do not have interior *corridors* serving *sleeping units* or *dwelling units* and where each *sleeping unit* or *dwelling unit* either has a *means of egress* door opening directly to an exterior *exit access* that leads directly to an *exit* or a *means of egress* door opening directly to an *exit*.

Required smoke alarms in *dwelling units* and *sleeping units* in Group R-2 occupancies operated by a college or university for student or staff housing shall be interconnected with the fire alarm system in accordance with NFPA 72.

[S] 907.2.9.4 Automatic heat detection. An automatic heat detection system that activates the occupant notification system in accordance with Section 907.6 shall be installed throughout all unsprinklered interior areas outside dwelling or sleeping units other than *attics* and crawl spaces.

[F] 907.2.10 Group S. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group S public- and self-storage occupancies three stories or greater in height for interior corridors and interior common areas. Visible notification appliances are not required within storage units. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group S occupancies where the combined area of all Group S *fire areas* on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m^2).

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.11 Single- and multiple-station smoke alarms. *Listed* single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.7 and NFPA 72.

[W][F] 907.2.11.1 Group R-1. Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In each *loft* constructed in accordance with Section 420.14.
3. ((~~2~~)) In every room in the path of the *means of egress* from the sleeping area to the door leading from the *sleeping unit*.
4. ((~~3~~)) In each *story* within the *sleeping unit*, including basements. For *sleeping units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.

[W][F] 907.2.11.2 Groups R-2, R-3, R-4 and I-1. Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-3, R-4 and I-1 regardless of *occupant load* at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. In each *loft* constructed in accordance with Section 420.14.
4. ((~~3~~)) In each *story* within a *dwelling unit*, including basements but not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.

[F] 907.2.11.3 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section 907.2.11.1 or 907.2.11.2:

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking appliance.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking appliance.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1829 mm) horizontally from a permanently installed cooking appliance.

[F] 907.2.11.4 Installation near bathrooms. Smoke alarms shall be installed not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by Section 907.2.11.1 or 907.2.11.2.

[F] 907.2.11.5 Interconnection. Where more than one smoke alarm is required to be installed within an individual *dwelling unit* or *sleeping unit* in Group R or I-1 occupancies, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms

shall not be required where *listed* wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

[S][F] 907.2.11.6 Power source. In new construction, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency ((~~electrical~~)) system in accordance with Section 2702. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exception: Smoke alarms are not required to be equipped with battery backup where they are connected to an emergency ((~~electrical~~)) system that complies with Section 2702.

[F] 907.2.11.7 Smoke detection system. Smoke detectors listed in accordance with UL 268 and provided as part of the building *fire alarm system* shall be an acceptable alternative to single- and multiple-station *smoke alarms* and shall comply with the following:

1. The *fire alarm* system shall comply with all applicable requirements in Section 907.
2. Activation of a smoke detector in a *dwelling unit* or *sleeping unit* shall initiate alarm notification in the *dwelling unit* or *sleeping unit* in accordance with Section 907.5.2.
3. Activation of a smoke detector in a *dwelling unit* or *sleeping unit* shall not activate alarm notification appliances outside of the *dwelling unit* or *sleeping unit*, provided that a supervisory signal is generated and monitored in accordance with Section 907.6.6.

[S][F] 907.2.12 Special amusement buildings. ((~~An~~)) When required by the fire code official, an automatic smoke detection system shall be provided in *special amusement buildings* in accordance with Sections 907.2.12.1 through 907.2.12.3.

[F] 907.2.12.1 Alarm. Activation of any single smoke detector, the *automatic sprinkler system* or any other automatic fire detection device shall immediately activate an audible and visible alarm at the building at a *constantly attended location* from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.12.2.

[F] 907.2.12.2 System response. The activation of two or more smoke detectors, a single smoke detector equipped with an *alarm verification feature*, the *automatic sprinkler system* or other *approved* fire detection device shall automatically do all of the following:

1. Cause illumination of the *means of egress* with light of not less than 1 footcandle (11 lux) at the walking surface level.
2. Stop any conflicting or confusing sounds and visual distractions.
3. Activate an *approved* directional exit marking that will become apparent in an emergency.
4. Activate a prerecorded message, audible throughout the *special amusement building*, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound that is distinctive from other sounds used during normal operation.

[F] 907.2.12.3 Emergency voice/alarm communication system. An emergency voice/alarm communication system, which is allowed to serve as a public address system, shall be installed in accordance with Section 907.5.2.2 and be audible throughout the entire *special amusement building*.

[S][F] 907.2.13 High-rise buildings. High-rise buildings shall be provided with an automatic smoke detection system in accordance with Section 907.2.13.1, a fire department communication system in accordance with Section 907.2.13.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

Exceptions:

1. Airport traffic control towers in accordance with Sections 412 and 907.2.22.
2. *Open parking garages* in accordance with Section 406.5.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1.
4. Low-hazard special occupancies in accordance with Section 503.1.1.

((~~5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415.~~

~~6~~)) 5. In Group I-1 and I-2 occupancies, the alarm shall sound at a *constantly attended location* and occupant notification shall be broadcast by the emergency voice/alarm communication system.

[F] 907.2.13.1 Automatic smoke detection. Automatic smoke detection in high-rise buildings shall be in accordance with Sections 907.2.13.1.1 and 907.2.13.1.2.

[F] 907.2.13.1.1 Area smoke detection. Area smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this

section shall activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.9, smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room that is not provided with sprinkler protection.
2. In each elevator machine room, machinery space, control room and control space and in elevator lobbies.

[F] 907.2.13.1.2 Duct smoke detection. Duct smoke detectors complying with Section 907.3.1 shall be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m^3/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m^3/s) and serving not more than 10 air-inlet openings.

[S][F] 907.2.13.2 Fire department communication system. Where a wired communication system is *approved* in lieu of an in-building two-way emergency responder communication coverage system in accordance with Section 510 of the *International Fire Code*, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 911, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, *areas of refuge* and inside *interior exit stairways*. The fire department communication device shall be provided at each floor level within the *interior exit stairway*. Eight portable handsets for the communication system shall be provided in the *fire command center*.

[F] 907.2.13.3 Multiple-channel voice evacuation. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, voice evacuation systems for high-rise buildings shall be multiple-channel systems.

[F] 907.2.14 Atriums connecting more than two stories. A fire alarm system shall be installed in occupancies with an *atrium* that connects more than two *stories*, with smoke detection installed in locations required by a rational analysis in Section 909.4 and in accordance with the system operation requirements in Section 909.17. The system shall be activated in accordance with Section 907.5. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.5.2.2.

[S][F] 907.2.15 High-piled combustible storage areas. An automatic ((~~smoke~~)) fire detection system shall be installed throughout high-piled combustible storage areas where required by Section 3206.5 of the *International Fire Code*.

[F] 907.2.16 Aerosol storage uses. *Aerosol product* rooms and general-purpose warehouses containing aerosol products shall be provided with an *approved* manual fire alarm system where required by the *International Fire Code*.

[F] 907.2.17 Lumber, wood structural panel and veneer mills. Lumber, *wood structural panel* and *veneer* mills shall be provided with a manual fire alarm system.

[F] 907.2.18 Underground buildings with smoke control systems. Where a smoke control system is installed in an underground building in accordance with this code, automatic smoke detectors shall be provided in accordance with Section 907.2.18.1.

[F] 907.2.18.1 Smoke detectors. Not fewer than one smoke detector *listed* for the intended purpose shall be installed in all of the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one *story* and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a *listed* smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cubic feet per minute (2.4 m^3/s) and serving not more than 10 air-inlet openings.

[F] 907.2.18.2 Alarm required. Activation of the smoke control system shall activate an audible alarm at a *constantly attended location*.

[F] 907.2.19 Deep underground buildings. Where the lowest level of a structure is more than 60 feet (18 288 mm) below the finished floor of the lowest *level of exit discharge*, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

[F] 907.2.20 Covered and open mall buildings. Where the total floor area exceeds 50,000 square feet (4645 m^2) within either a *covered mall building* or within the perimeter line of an *open mall building*, an emergency voice/alarm communication system shall be provided. Access to emergency voice/alarm communication systems serving a mall, required or otherwise, shall be provided for the fire department. The system shall be provided in accordance with Section 907.5.2.2.

[F] 907.2.21 Residential aircraft hangars. Not fewer than one single-station smoke alarm shall be installed within a *residential aircraft hangar* as defined in Chapter 2 and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the *dwelling*.

[F] 907.2.22 Airport traffic control towers. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in airport control towers in accordance with Sections 907.2.22.1 and 907.2.22.2.

Exception: Audible appliances shall not be installed within the control tower cab.

[F] 907.2.22.1 Airport traffic control towers with multiple exits and automatic sprinklers. Airport traffic control towers with multiple *exits* and equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Outside each opening into *interior exit stairways*.
5. Along the single *means of egress* permitted from observation levels.
6. Outside each opening into the single *means of egress* permitted from observation levels.

[F] 907.2.22.2 Other airport traffic control towers. Airport traffic control towers with a single exit or where sprinklers are not installed throughout shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.
6. *Means of egress.*
7. Utility *shafts* where access to smoke detectors can be provided.

[F] 907.2.23 Energy storage systems. An automatic smoke detection system or radiant-energy detection system shall be installed in rooms, areas and walk-in units containing energy storage systems as required in Section 1207.5.4 of the *International Fire Code*.

[F] 907.3 Fire safety functions. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a *constantly attended location*. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

[S][F] 907.3.1 Duct smoke detectors. Smoke detectors installed in ducts shall be *listed* for the air velocity, temperature and humidity present in the duct. Duct smoke detectors shall be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a *constantly attended location* and shall perform the intended fire safety function in accordance with this code and the *International Mechanical Code*. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal and not as a fire alarm. They shall not be used as a substitute for required open area detection and shall not activate the occupant notification system.

((~~Exceptions:~~

1. ~~The supervisory signal at a *constantly attended location* is not required where duct smoke detectors activate the building's alarm notification appliances.~~

~~2.~~)) **Exception:** In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an *approved* location. Smoke detector trouble conditions shall activate a visible or audible signal in an *approved* location and shall be identified as air duct detector trouble.

[F] 907.3.2 Special locking systems. Where special locking systems are installed on *means of egress* doors in accordance with Sections 1010.2.13 or 1010.2.14, an automatic detection system shall be installed as required by that section.

[S][F] 907.3.3 Elevator emergency operation. Automatic fire detectors installed for elevator emergency operation shall be installed in accordance with the provisions of ((~~ASME A17.1/CSA B44 and NFPA 72~~)) rules promulgated by the *building official* or *fire code official*.

[F] 907.3.4 Wiring. The wiring to the auxiliary devices and equipment used to accomplish the fire safety functions shall be monitored for integrity in accordance with NFPA 72.

[F] 907.4 Initiating devices. Where a fire alarm system is required by another section of this code, occupant notification in accordance with Section 907.5 shall be initiated by one or more of the following. Initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

1. Manual fire alarm boxes.
2. Automatic fire detectors.
3. *Automatic sprinkler system* waterflow devices.
4. Automatic fire-extinguishing systems.

[F] 907.4.1 Protection of fire alarm control unit. In areas that are not continuously occupied, a single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

Exception: Where ambient conditions prohibit installation of a smoke detector, a *heat detector* shall be permitted.

[F] 907.4.2 Manual fire alarm boxes. Where a manual fire alarm system is required by another section of this code, it shall be activated by fire alarm boxes installed in accordance with Sections 907.4.2.1 through 907.4.2.6.

[F] 907.4.2.1 Location. Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each *exit*. In buildings not protected by an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2, additional manual fire alarm boxes shall be located so that the distance of travel to the nearest box does not exceed 200 feet (60 960 mm).

[F] 907.4.2.2 Height. The height of the manual fire alarm boxes shall be not less than 42 inches (1067 mm) and not more than 48 inches (1372 mm) measured vertically, from the floor level to the activating handle or lever of the box.

[F] 907.4.2.3 Color. Manual fire alarm boxes shall be red in color.

[F] 907.4.2.4 Signs. Where fire alarm systems are not monitored by an *approved* supervising station in accordance with Section 907.6.6, an *approved* permanent sign shall be installed adjacent to each manual fire alarm box that reads: WHEN ALARM SOUNDS CALL FIRE DEPARTMENT.

Exception: Where the manufacturer has permanently provided this information on the manual fire alarm box.

[F] 907.4.2.5 Protective covers. The fire code official is authorized to require the installation of *listed* manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local *alarm signal* shall not be installed unless *approved*. Protective covers shall not project more than that permitted by Section 1003.3.3.

[F] 907.4.2.6 Unobstructed and unobscured. Manual fire alarm boxes shall be provided with ready access, unobstructed, unobscured and visible at all times.

[F] 907.4.3 Automatic smoke detection. Where an automatic smoke detection system is required, it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, *approved* automatic *heat detectors* shall be permitted.

[F] 907.4.3.1 Automatic sprinkler system. For conditions other than specific fire safety functions noted in Section 907.3, in areas where ambient conditions prohibit the installation of smoke detectors, an *automatic sprinkler system* installed in such areas in accordance with Section 903.3.1.1 or 903.3.1.2 and that is connected to the fire alarm system shall be *approved* as automatic heat detection.

[F] 907.5 Occupant notification. Occupant notification by fire alarms shall be in accordance with Sections 907.5.1 through 907.5.2.3.3. Occupant notification by smoke alarms in Group R-1 and R-2 occupancies shall comply with Section 907.5.2.1.3.2.

907.5.1 Alarm activation and annunciation. Upon activation, fire alarm systems shall initiate occupant notification and shall annunciate at the fire alarm control unit, or where allowed elsewhere by Section 907, at a *constantly attended location*.

907.5.1.1 Presignal feature. A presignal feature shall be provided only where *approved*. The presignal shall be annunciated at an approved, *constantly attended location,* having the capability to activate the occupant notification system in the event of fire or other emergency.

[F] 907.5.2 Alarm notification appliances. Alarm notification appliances shall be provided and shall be *listed* for their purpose.

[S][F] 907.5.2.1 Audible alarms. Audible alarm notification appliances shall be provided and emit a distinctive sound that is not to be used for any purpose other than that of a fire alarm.

Exceptions:

1. Audible alarm notification appliances are not required in critical care areas of Group I-2, Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
2. A visible *alarm notification appliance* installed in a nurses' control station or other continuously attended staff location in a Group I-2, Condition 2 suite shall be an acceptable alternative to the installation of audible alarm notification appliances throughout a suite or unit in Group I-2, Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
3. Where provided, audible notification appliances located in each enclosed occupant evacuation elevator lobby in accordance with Section ((~~3008.9.1~~)) 403.6.2.10.1 shall be connected to a separate notification zone for manual paging only.

[S][F] 907.5.2.1.1 Average sound pressure. The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the *average ambient sound level* or 5 dBA above the maximum sound level having a duration of not less than 60 seconds, whichever is greater, in every *occupiable space* within the building. The minimum sound pressure levels shall be: 75 dBA in occupancies in Groups R and I-Condition 1; 90 dBA in mechanical equipment rooms; and 60 dBA in other occupancies.

Exceptions:

1. Private mode signaling in accordance with NFPA 72 is allowed in areas of I-2 and I-3 occupancies if occupants are not expected to self-evacuate.
2. Alarm systems installed in selected parts of a building are required to meet sound pressure requirements within the selected area of the building only.

[W][S][F] 907.5.2.1.2 Maximum sound pressure. The ((~~total~~)) maximum sound pressure level ((~~produced by combining the ambient sound pressure level with all~~)) for audible notification appliances ((~~operating~~)) shall ((~~not exceed~~)) be 110 dBA at the minimum hearing distance from the audible appliance. For systems operating in the public mode, the maximum sound pressure level shall not exceed 30 dBA over the average ambient sound level. Where the average ambient noise is greater than ((~~105~~)) 95 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

[F] 907.5.2.1.3 Audible signal frequency in Group R-1 and R-2 sleeping rooms. Audible signal frequency in Group R-1 and R-2 occupancies shall be in accordance with Sections 907.5.2.1.3.1 and 907.5.2.1.3.2.

[F] 907.5.2.1.3.1 Fire alarm system signal. In sleeping rooms of Group R-1 and R-2 occupancies, the audible alarm activated by a fire alarm system shall be a 520-Hz low-frequency signal complying with NFPA 72.

[F] 907.5.2.1.3.2 Smoke alarm signal in sleeping rooms. In sleeping rooms of Group R-1 and R-2 occupancies that are required by Section 907.2.8 or 907.2.9 to have a fire alarm system, the audible *alarm signal* activated by single- or multiple-station smoke alarms in the *dwelling unit* or *sleeping unit* shall be a 520-Hz signal complying with NFPA 72. Where a sleeping room smoke alarm is unable to produce a 520-Hz signal, the 520-Hz *alarm signal* shall be provided by a *listed* notification appliance or a smoke detector with an integral 520-Hz sounder.

[S][F] 907.5.2.2 Emergency voice/alarm communication systems. Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving *approved* information and directions for a general or staged evacuation in accordance with the building's fire safety and evacuation plans required by Section 404 of the *International Fire Code*. In high-rise buildings, the system shall operate on at least the alarming floor, the floor above and ((~~the floor~~)) two floors below. Speakers shall be provided throughout the building by paging zones. At a minimum, paging zones shall be provided as follows:

1. Elevator groups.
2. *Interior exit stairways.*
3. Each floor.
4. *Areas of refuge* as defined in Chapter 2.

Exception: In Group I-1 and I-2 occupancies, the alarm shall sound in a constantly attended area and a general occupant notification shall be broadcast over the overhead page.

[F] 907.5.2.2.1 Manual override. A manual override for emergency voice communication shall be provided on a selective and all-call basis for all paging zones.

[F] 907.5.2.2.2 Live voice messages. The emergency voice/alarm communication system shall have the capability to broadcast live voice messages by paging zones on a selective and all-call basis.

[F] 907.5.2.2.3 Alternative uses. The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided that the manual fire alarm use takes precedence over any other use.

[F] 907.5.2.2.4 Emergency voice/alarm communication captions. Where stadiums, arenas and *grandstands* have 15,000 fixed seats or more and provide audible public announcements, the emergency/voice alarm communication system shall provide prerecorded or real-time captions. Prerecorded or live emergency captions shall be from an *approved* location constantly attended by personnel trained to respond to an emergency.

[S][F] 907.5.2.2.5 Standby power. Emergency voice/alarm communications systems shall be provided with *legally required standby power* in accordance with Section 2702.

[S] 907.5.2.2.6 Voice intelligibility. Voice intelligibility is required in acoustically distinguished spaces, such as interior dwelling and sleeping units. Voice intelligibility is not required in acoustically distinguished spaces that meet the following conditions:

1. The alert tone within such spaces provides audible levels meeting the requirements of Section 907.5.2.1.1 of the *Seattle Fire Code*.
2. Such spaces are within 30 feet travel distance to a space that does meet voice intelligibility requirements.

[S][F] 907.5.2.3 Visible alarms. Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.3 and rules promulgated by the *building official* or *fire code official*.

Exceptions:

1. Visible alarm notification appliances are not required in *alterations*, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.
2. Visible alarm notification appliances shall not be required in *exits* as defined in Chapter 2.
3. Visible alarm notification appliances shall not be required in elevator cars.
4. Visual alarm notification appliances are not required in critical care areas of Group I-2, Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
5. A visible *alarm notification appliance* installed in a nurses' control station or other continuously attended staff location in a Group I-2, Condition 2 suite shall be an acceptable alternative to the installation of visible alarm notification appliances throughout the suite or unit in Group I-2, Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
6. Alarm systems installed in selected parts of a building are required to meet sound pressure requirements within the selected area of the building only.

[F] 907.5.2.3.1 Public use areas and common use areas. Visible alarm notification appliances shall be provided in *public use areas* and *common use areas*.

Exception: Where *employee work areas* have audible alarm coverage, the notification appliance circuits serving the *employee work areas* shall be initially designed with not less than 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing-impaired employee(s).

[F] 907.5.2.3.2 Groups I-1 and R-1. *Habitable spaces* in *dwelling units* and *sleeping units* in Group I-1 and R-1 occupancies in accordance with Table 907.5.2.3.2 shall be provided with visible alarm notification. Visible alarms shall be activated by the in-room smoke alarm and the building fire alarm system.

[F] TABLE 907.5.2.3.2
VISIBLE ALARMS

NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12

[F] TABLE 907.5.2.3.2—continued
VISIBLE ALARMS

NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

[F] 907.5.2.3.3 Group R-2. In Group R-2 occupancies required by Section 907 to have a fire alarm system, each *story* that contains *dwelling units* and *sleeping units* shall be provided with the capability to support future visible alarm notification appliances in accordance with Chapter 11 of ICC A117.1. Such capability shall accommodate wired or wireless equipment.

[F] 907.5.2.3.3.1 Wired equipment. Where wired equipment is used to comply with the future capability required by Section 907.5.2.3.3, the system shall include one of the following capabilities:

1. The replacement of audible appliances with combination audible/visible appliances or additional visible notification appliances.
2. The future extension of the existing wiring from the unit smoke alarm locations to required locations for visible appliances.
3. For wired equipment, the fire alarm power supply and circuits shall have not less than 5-percent excess capacity to accommodate the future addition of visible alarm notification appliances, and a single access point to such circuits shall be available on every story. Such circuits shall not be required to be extended beyond a single access point on a story. The fire alarm system shop drawings required by Section 907.1.2 shall include the power supply and circuit documentation to accommodate the future addition of visible notification appliances.

[F] 907.6 Installation and monitoring. A fire alarm system shall be installed and monitored in accordance with Sections 907.6.1 through 907.6.6.3 and NFPA 72.

[S][F] 907.6.1 Wiring. Wiring shall comply with the requirements of ((~~NFPA 70~~)) the *Seattle Electrical Code* and NFPA 72. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

[F] 907.6.2 Power supply. The primary and secondary power supply for the fire alarm system shall be provided in accordance with NFPA 72.

Exception: Back-up power for single-station and multiple-station smoke alarms as required in Section 907.2.11.6.

[F] 907.6.3 Initiating device identification. The fire alarm system shall identify the specific *initiating device* address, location, device type, floor level where applicable and status including indication of normal, alarm, trouble and supervisory status, as appropriate.

Exceptions:

1. Fire alarm systems in single-*story* buildings less than 22,500 square feet (2090 m^2) in area.
2. Fire alarm systems that only include manual fire alarm boxes, waterflow initiating devices and not more than 10 additional alarm-initiating devices.
3. Special initiating devices that do not support individual device identification.
4. Fire alarm systems or devices that are replacing existing equipment.

[F] 907.6.3.1 Annunciation. The *initiating device* status shall be annunciated at an *approved* on-site location.

[S][F] 907.6.4 Zones. Each floor shall be zoned separately and a zone shall not exceed 22,500 square feet (2090 m^2). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

Exception: *Automatic sprinkler system* zones shall not exceed the area permitted by NFPA 13.

[F] 907.6.4.1 ((~~Zoning indicator~~)) Annunciator panel. ((~~A zoning indicator panel and the associated controls shall be provided in an *approved* location.~~)) All fire alarm systems in buildings without a fire command center shall be provided with an annunciator panel (or the main fire alarm control panel) located inside the building at the main building entrance. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible-alarm silencing switch.

[S][F] 907.6.4.2 High-rise buildings. In high-rise buildings, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes other than the manual fire alarm box located in the fire command center.
4. Other *approved* types of automatic *fire protection systems*.

[F] 907.6.5 Access. Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

[S][F] 907.6.6 Monitoring. Fire alarm systems required by this chapter or by the *International Fire Code* shall be monitored by an *approved* supervising station in accordance with NFPA 72.

Exception: Monitoring by a supervising station is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. *Automatic sprinkler systems* in one- and two-family dwellings and townhouses where each townhouse unit is provided with a dedicated sprinkler system.

[F] 907.6.6.1 Transmission of alarm signals. Transmission of alarm signals to a supervising station shall be in accordance with NFPA 72.

[F] 907.6.6.2 MIY Monitoring. Direct transmission of alarms associated with monitor it yourself (MIY) transmitters to a public safety answering point (PSAP) shall not be permitted unless *approved* by the *fire code official*.

[F] 907.6.6.3 Termination of monitoring service. Termination of fire alarm monitoring services shall be in accordance with Section 901.9 of the *International Fire Code*.

[S][F] 907.7 Acceptance tests and completion. Upon completion of the installation or portion thereof, and after the electrical inspector has approved the installation or portion thereof, the fire alarm system and all fire alarm components or portion thereof shall be tested in accordance with NFPA 72.

[F] 907.7.1 Single- and multiple-station alarm devices. When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the smoke alarm provisions of NFPA 72.

[F] 907.7.2 Record of completion. A record of completion in accordance with NFPA 72 verifying that the system or portion thereof has been installed and tested in accordance with the *approved* plans and specifications shall be provided.

[F] 907.7.3 Instructions. Operating, testing and maintenance instructions and *record drawings* ("as-builts") and equipment specifications shall be provided at an *approved* location.

[F] 907.8 Inspection, testing and maintenance. The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Section 907.8 of the *International Fire Code*.

SECTION 908
EMERGENCY ALARM SYSTEMS

[F] 908.1 Group H occupancies. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section 415.5.

[F] 908.2 Group H-5 occupancy. Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 415.11.4.

[S][F] 908.3 Fire alarm system interface. Where an emergency alarm system is interfaced with a building's fire alarm system, the signal produced at the fire alarm control unit shall be a supervisory signal by the fire code official.

SECTION 909
SMOKE CONTROL SYSTEMS

[F] 909.1 Scope and purpose. This section applies to mechanical or passive smoke control systems where they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different

purpose than the smoke- and heat-removal provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *International Mechanical Code*.

[S] 909.1.1 Smoke control presubmittal conference. The applicant shall arrange a smoke control presubmittal conference at least 60 days prior to submittal of a building permit application that contains the construction documents for any architectural components of the building. The purpose of this presubmittal conference is to obtain conceptual approval of the design team approach to compliance with the smoke control provisions in this section.

[F] 909.2 General design requirements. Buildings, structures or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The *construction documents* shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

[F] 909.3 Special inspection and test requirements. In addition to the ordinary inspection and test requirements that buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 shall undergo *special inspections* and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the *construction documents* shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The *special inspections* and tests required by this section shall be conducted under the same terms in Section 1704.

[F] 909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted *construction documents* and shall include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.7.

[F] 909.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

[F] 909.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

[F] 909.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16.

[F] 909.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.

[F] 909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

[F] 909.4.6 Duration of operation. All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

909.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

[F] 909.5 Smoke barrier construction. *Smoke barriers* required for passive smoke control and a smoke control system using the pressurization method shall comply with Section 709. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls $A/A_w = 0.00100$
2. Interior *exit stairways* and *ramps* and *exit passageways*: $A/A_w = 0.00035$
3. Enclosed *exit access stairways* and *ramps* and all other *shafts*: $A/A_w = 0.00150$
4. Floors and roofs: $A/A_F = 0.00050$

where:

A = Total leakage area, square feet (m^2).

A_F = Unit floor or roof area of barrier, square feet (m^2).

A_w = Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings due to gaps around doors and operable windows. The total leakage area of the *smoke barrier* shall be determined in accordance with Section 909.5.1 and tested in accordance with Section 909.5.2.

[F] 909.5.1 Total leakage area. Total leakage area of the barrier is the product of the *smoke barrier* gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

[S][F] 909.5.2 Testing of leakage area. Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as *approved* by the ((~~fire code~~)) *building official*.

[F] 909.5.3 Opening protection. Openings in *smoke barriers* shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by *fire door assemblies* complying with Section 716.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors *listed* for releasing service installed in accordance with Section 907.3.
2. Fixed openings between smoke zones that are protected utilizing the airflow method.
3. In Group I-1, Condition 2; Group I-2; and *ambulatory care facilities*, where a pair of opposite-swinging doors are installed across a *corridor* in accordance with Section 909.5.3.1, the doors shall not be required to be protected in accordance with Section 716. The doors shall be close-fitting within operational tolerances and shall not have a center mullion or undercuts in excess of 3/4 inch (19.1 mm), louvers or grilles. The doors shall have head and jamb stops and astragals or rabbets at meeting edges and, where permitted by the door manufacturer's listing, positive-latching devices are not required.
4. In Group I-2 and *ambulatory care facilities*, where such doors are special-purpose horizontal sliding, accordion or folding door assemblies installed in accordance with Section 1010.3.3 and are automatic closing by smoke detection in accordance with Section 716.2.6.5.
5. Group I-3.
6. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.

909.5.3.1 Group I-1, Condition 2; Group I-2; and ambulatory care facilities. In Group I-1, Condition 2; Group I-2; and *ambulatory care facilities*, where doors are installed across a *corridor*, the doors shall be automatic closing by smoke detection in accordance with Section 716.2.6.5 and shall have a vision panel with fire-protection-rated glazing materials in fire protection-rated frames, the area of which shall not exceed that tested.

[F] 909.5.3.2 Ducts and air transfer openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) *smoke damper* complying with Section 717.

[F] 909.6 Pressurization method. The primary mechanical means of controlling smoke shall be by pressure differences across *smoke barriers*. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

[F] 909.6.1 Minimum pressure difference. The pressure difference across a *smoke barrier* used to separate smoke zones shall be not less than 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences not less than two times the maximum calculated pressure difference produced by the design fire.

[F] 909.6.2 Maximum pressure difference. The maximum air pressure difference across a *smoke barrier* shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1010.1.3. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W\text{-}d) \qquad \textbf{(Equation 9-1)}$$

where:

A = Door area, square feet (m^2).
d = Distance from door handle to latch edge of door, feet (m).
F = Total door opening force, pounds (N).
F_{dc} = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches of water (Pa).

[S][F] 909.6.3 Pressurized stairways and elevator hoistways. Where *stairways* or elevator hoistways are pressurized, such pressurization systems shall comply with Section 909 as smoke control systems, in addition to the requirements of Sections 909.20 ((~~of this code~~)) and 909.21. ((~~of the *International Fire Code*.~~))

[S][F] 909.7 Airflow design method. Where *approved* by the ((~~fire code~~)) building official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92.

[F] 909.7.1 Prohibited conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. Airflow toward the fire shall not exceed 200 feet per minute (1.02 m/s). Where the calculated airflow exceeds this limit, the airflow method shall not be used.

[S][F] 909.8 Exhaust method. Where *approved* by the ((~~fire code~~)) building official, mechanical smoke control for large enclosed volumes, such as in *atriums* or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

[F] 909.8.1 Smoke layer. The height of the lowest horizontal surface of the smoke layer interface shall be maintained not less than 6 feet (1829 mm) above a walking surface that forms a portion of a required egress system within the smoke zone.

[S][F] 909.9 Design fire. The design fire shall be based on a rational analysis performed by the *registered design professional* and *approved* by the ((~~fire code~~)) building official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section. A design fire is not required for stairway and elevator hoistway pressurization system designs.

[F] 909.9.1 Factors considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

[F] 909.9.2 Design fire fuel. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

[F] 909.9.3 Heat-release assumptions. The analysis shall make use of best available data from *approved* sources and shall not be based on excessively stringent limitations of combustible material.

[F] 909.9.4 Sprinkler effectiveness assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

[S][F] 909.10 Equipment. Equipment including, but not limited to, fans, ducts, automatic *dampers* and balance *dampers*, shall be ((~~suitable~~)) listed for its intended use, ((~~suitable~~)) listed for the probable exposure temperatures that the rational analysis indicates and as *approved* by the ((~~fire code~~)) building official.

[F] 909.10.1 Exhaust fans. Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

Exception: An elevated temperature rating is not required for ventilation system fans used to assist in achieving stairway and elevator hoistway pressure differential relationships.

$$T_s = (Q_c/mc) + (T_a) \quad \textbf{(Equation 9-2)}$$

where:

c = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg × K).

m = Exhaust rate, pounds per second (kg/s).

Q_c = Convective heat output of fire, Btu/s (kW).

T_a = Ambient temperature, °F (K).

T_s = Smoke temperature, °F (K).

Exception: Reduced T_s as calculated based on the assurance of adequate dilution air.

[F] 909.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *International Mechanical Code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of

such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exceptions:

1. Duct leakage testing is not required for stairway or elevator hoistway pressurization systems.
2. Noncombustible supports are not required in low-rise buildings of combustible construction.
3. Flexible connections, for the purpose of vibration isolation, complying with the *International Mechanical Code* and that are constructed of *approved* fire-resistance-rated materials.

[F] 909.10.3 Equipment, inlets and outlets. Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located ((~~so~~)) as required by Sections 909.20.5 and 909.20.6, to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

[F] 909.10.4 Automatic dampers. Automatic *dampers*, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of *approved*, recognized standards.

[F] 909.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of Chapter 16.

Exceptions:

1. An elevated temperature rating is not required for stairway and elevator hoistway pressurization supply air fans or for ventilation system fans used to assist in achieving stairway and elevator hoistway pressure differential relationships.
2. Noncombustible supports are not required in low-rise buildings of combustible construction.

Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from measurement of actual current draw, and shall have a minimum service factor of 1.15.

[S][F] 909.11 ((~~Standby~~)) Emergency power. Smoke control systems shall be provided with ((~~standby~~)) emergency power in accordance with Section 2702.

Exceptions:

1. Stairway pressurization systems for low-rise buildings are permitted to be provided with legally required standby power in accordance with Section 909.20.6.
2. Hoistway pressurization systems for low-rise buildings are permitted to be provided with legally required standby power in accordance with Section 909.21.5.

Interpretation I909.11: Other building ventilation system fans used to achieve stairway or elevator hoistway pressure differential relationships are considered to be part of the smoke control system and are required to be provided with emergency power in high-rise buildings.

909.11.1 Equipment room. The ((~~standby~~)) emergency power source and its transfer switches shall be in a room separate from the normal power transformers and switch gears and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Exceptions:

1. Where located within a sprinklered parking garage of Type I or II construction, emergency power and *legally required standby power systems* with fixed fuel quantities meeting the limits of Section 603.3 of the International Fire Code, and their transfer switches, are not required to be in a separate room. Other occupancies located in the story where the system is located shall be separated from the system by fire barriers with a minimum 1 hour fire-resistance rating.
2. Combustion and radiator intake air are permitted to be transferred from the adjacent garage. Radiator discharge air is permitted to be transferred to the adjacent garage. Radiator ventilation intake and discharge air locations shall be separated to maintain the radiator ventilation intake air temperature below the maximum temperature allowed to meet the emergency and *legally required standby power system* loads.

[F] 909.11.2 Power sources and power surges. Elements of the smoke control system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span 15-minute primary power interrup-

tion. Elements of the smoke control system susceptible to power surges shall be suitably protected by conditioners, suppressors or other *approved* means.

909.11.3 Wiring. In addition to meeting requirements of the *Seattle Electrical Code*, all wiring, regardless of voltage, shall have fire-resistance-rated protection of at least two hours or as required in rules promulgated by the *building official*.

Exceptions:

1. Subject to the approval of the *building official*, fire-resistance rating is not required for wiring located in a parking garage.
2. Wiring serving building ventilation system fans used to achieve stairway or elevator hoistway pressure differential relationships need not be protected unless protection is required by other provisions in this or other codes.
3. Wiring serving stairway or elevator hoistway pressurization systems in low-rise buildings is permitted to have fire-resistance-rated protection consistent with the fire-resistance rating of the stairway or elevator hoistway.

[S][F] 909.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and *listed* as smoke control equipment.

909.12.1 Verification. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

Exceptions:

1. Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing, where *approved* by the building official and in accordance with both of the following:
   1.1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a *listed* control unit.
   1.2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section ((~~909.20.6~~)) 909.22.6 of the *International Fire Code*.
2. Weekly testing is not required for stairway and hoistway pressurization systems.

[F] 909.12.2 Wiring. ((~~In addition to meeting requirements of NFPA 70, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.~~)) See Section 909.11.3.

[F] 909.12.3 Activation. Smoke control systems shall be activated in accordance with this section.

[F] 909.12.3.1 Pressurization, airflow or exhaust method. Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

[F] 909.12.3.2 Passive method. Passive smoke control systems actuated by *approved* spot-type detectors *listed* for releasing service shall be permitted.

[F] 909.12.4 Automatic control. Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned *automatic sprinkler system* complying with Section 903.3.1.1, manual controls provided with *ready access* for the fire department and any smoke detectors required by engineering analysis.

[F] 909.13 Control air tubing. Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

[S][F] 909.13.1 Materials. Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B42, ASTM B43, ASTM B68/B68M, ASTM B88, ASTM B251 and ASTM B280. Fittings shall be wrought copper or brass, solder type in accordance with ASME B16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP-5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices provided that all of the following conditions are met:

1. Tubing shall comply with the requirements of Section 602.2.1.3 of the ((~~*International*~~)) *Seattle Mechanical Code*.

2. Tubing and connected devices shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or Teflon or by suitable brass compression to male barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing connected to devices on doors shall be fastened along hinges.

[F] 909.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

[F] 909.13.3 Testing. Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

[F] 909.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

[S][F] 909.15 Control diagrams. Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file ((~~with the fire code official, the fire department and~~)) in the fire command center. ((~~in a format and manner *approved* by the *fire code official.*~~))

Exception: Control diagrams for stairway or elevator hoistway pressurization systems in low-rise buildings shall be located at the fire alarm control panel.

[S][F] 909.16 Fire fighter's smoke control panel. A fire fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 911 in high-rise buildings or buildings with smoke-protected assembly seating. In all other buildings, the fire fighter's smoke control panel shall be installed in an *approved* location adjacent to the fire alarm control panel. The fire fighter's smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

The smoke control panel for high rise buildings shall include a visual depiction of the building showing typical floor plan(s) with locations of interior exit stairways and elevator hoistways. The panel shall also include section views of the building to show the extent of travel for each interior exit stairway and elevator. Interior exit stairways and elevator hoistways shall be labeled on the plan section views to match the labeling used in the building itself.

Exception: For buildings that use only stairway and elevator hoistway pressurization for smoke control, pressurization fan status and controls in accordance with Section 909.16.2 (or equivalent) may be installed on the main fire alarm control panel (FACP) in lieu of installing a dedicated fire fighter's smoke control panel. The building graphics normally provided on the smoke control panel shall be laminated and mounted in the vicinity of the FACP for quick reference by emergency responders.

Note: This exception may be applied to ventilation systems other than interior exit stairway supply air systems to exhaust air from adjacent space.

[F] 909.16.1 Smoke control systems. Fans within the building shall be shown on the fire fighter's control panel. Fan control switches shall be located on the panel in the vicinity of the location where the shaft supplied by each fan is depicted. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all ((~~smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators~~)) fans as follows:

1. Fans ((~~, *dampers* and other operating equipment~~)) in ((~~their normal~~)) a ready/non-operating status—WHITE.
2. Fans ((~~, *dampers* and other operating equipment~~)) in their off ((~~or closed~~)) status—RED.
3. Fans ((~~, *dampers* and other operating equipment~~)) in ((~~their on or open status~~)) operation—GREEN.
4. Fans ((~~, *dampers* and other operating equipment~~)) in a fault ((~~status~~)) condition—YELLOW/AMBER.

[F] 909.16.2 Smoke control panel. The fire fighter's control panel shall provide control capability over the complete smoke control system equipment within the building as follows:

1. ON-AUTO-OFF control over each ((~~individual piece of operating smoke control equipment that can be controlled from other sources within the building~~)) shaft pressurization fan. ((~~This includes *stairway* pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator *shaft* fans and other operating equipment used or intended for smoke control purposes.~~
2. ~~OPEN-AUTO-CLOSE control over individual *dampers* relating to smoke control and that are controlled from other sources within the building.~~

~~3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire fighter's control panel.~~))

2. AUTO-OFF-POSITIVE PRESSURE-NEGATIVE PRESSURE control over each smoke control zone designed with such features. Individual control of each damper and fan used to achieve the positive or negative pressure condition is not required.
3. AUTO-EXHAUST-OFF control over each smoke control zone using the exhaust method of smoke control.

Exceptions:

1. Complex systems, where *approved*, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where *approved*, where the control is accomplished by computer interface using *approved*, plain English commands.

[S][F] 909.16.3 Control action and priorities. The fire-fighter's control panel actions shall be as follows:

1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire fighter's control panel, automatic or manual control from any other control point within the building shall not contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment including, but not limited to, duct freezestats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices, such means shall be capable of being overridden by the fire fighter's control panel. The last control action as indicated by each fire fighter's control panel switch position shall prevail. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

   Exception: Power disconnects required by ((~~NFPA 70~~)) the *Seattle Electrical Code*.

2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described in Section 909.16.1. Where directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

[F] 909.17 System response time. Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as *dampers* and fans) in the sequence necessary to prevent physical damage to the fans, *dampers*, ducts and other equipment. For purposes of smoke control, the fire fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. Upon receipt of an alarm condition at the fire alarm control panel, fans, dampers and automatic doors shall have achieved their proper operating state and the final status shall be indicated at the smoke control panel within 90 seconds. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

[S][F] 909.18 Acceptance testing. Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, or as required in rules promulgated by the *building official*, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

[F] 909.18.1 Detection devices. Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. Where applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

Note: Verification of airflow in stairway or elevator hoistway pressurization systems is only required to verify compliance with duct detector listing.

[F] 909.18.2 Ducts. Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

Exception: Ducts that are part of a stairway or elevator hoistway pressurization system need not be traversed.

[F] 909.18.3 Dampers. *Dampers* shall be tested for function in their installed condition.

[F] 909.18.4 Inlets and outlets. Inlets and outlets shall be read using generally accepted practices to determine air quantities.

Exception: Air quantities are not required to be determined for stairway or elevator hoistway pressurization systems unless specifically required by other sections in this code.

[F] 909.18.5 Fans. Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

[F] 909.18.6 Smoke barriers. Measurements using inclined manometers or other *approved* calibrated measuring devices shall be made of the pressure differences across *smoke barriers*. Such measurements shall be conducted for each possible smoke control condition.

[F] 909.18.7 Controls. Each smoke zone equipped with an automatic-initiation device shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire fighter's control panel and simulation of ((~~standby~~)) emergency power conditions.

[S][F] 909.18.8 Testing for smoke control. Smoke control systems shall be tested by a *special inspector* for compliance with the *approved* design in accordance with Section ((~~1705.19~~)) 1705.18.

[S][F] 909.18.8.1 Scope of testing. Testing shall be conducted ((~~in accordance with the following:~~)) prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

((~~1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.~~

~~2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.~~))

[F] 909.18.8.2 Qualifications. *Approved* agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

[S][F] 909.18.8.3 Reports. A complete report of testing and a maintenance and operational testing program per *Seattle Fire Code* Section 909.22 shall be prepared by the *approved* agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or *mark*. The report shall be reviewed by the responsible *registered design professional* and, when satisfied that the design intent has been achieved, the responsible *registered design professional* shall sign, seal and date the report.

[S][F] 909.18.8.3.1 Report filing. ((~~A copy~~)) Copies of the final report and the maintenance and operational testing program per Section 909.22.1 shall be filed with the building official and the *fire code official*. ((~~and an~~)) An identical copy shall be maintained in an *approved* location at the building and shall be made available to the fire department on request.

Exception: A copy of the final report need not be maintained at low-rise buildings using stairway or elevator hoistway pressurization.

[F] 909.18.9 Identification and documentation. Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an *approved* identifying tag or *mark* on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

[S][F] 909.19 System acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the ((~~fire code~~)) *building official* determines that the provisions of this section have been fully ((~~complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system and a written maintenance program complying with the requirements of Section 909.20.1 of the *International Fire Code* has been submitted and approved by the fire code official~~)) met.

Exception: In buildings of phased construction, a temporary certificate of occupancy, as *approved* by the ((~~fire code~~)) building official, shall be allowed provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

[S] 909.20 ((~~Smokeproof enclosures~~)) Reserved. ((~~Where required by Section 1023.12, a *smokeproof enclosure* shall be constructed in accordance with this section. A *smokeproof enclosure* shall consist of an *interior exit stairway* or *ramp* that is enclosed in accordance with the applicable provisions of Section 1023 and an open exterior balcony, ventilated vestibule or pressurized *stair* and pressurized entrance vestibule meeting the requirements of this section. Where access to the roof is required by the *International Fire Code*, such access shall be from the *smokeproof enclosure* where a *smokeproof enclosure* is required.~~))

909.20.1 ((~~Access~~)) Reserved. ((~~Access to the *stairway* or *ramp* shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall be not less than the required width of the *corridor* leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.~~))

909.20.2 ((~~Construction~~)) Reserved. ((~~The *smokeproof enclosure* shall be separated from the remainder of the building by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Openings are not permitted other than the required *means of egress* doors. The vestibule shall be separated from the *stairway* or *ramp* by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The open exterior balcony shall be constructed in accordance with the *fire resistance rating* requirements for floor assemblies.~~

~~909.20.2.1 Door closers.~~ ~~Doors in a *smokeproof enclosure* shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 716.2.6.6 and shall be installed at the floor-side entrance to the *smokeproof enclosure*. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the *smokeproof enclosure* at all levels. Smoke detectors shall be installed in accordance with Section 907.3.~~))

909.20.3 ((~~Natural ventilation alternative~~)) Reserved. ((~~The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of *smokeproof enclosures* by natural means.~~

~~909.20.3.1 Balcony doors.~~ ~~Where access to the *stairway* or *ramp* is by way of an open exterior balcony, the door assembly into the enclosure shall be a *fire door assembly* in accordance with Section 716.~~

~~909.20.3.2 Vestibule doors.~~ ~~Where access to the *stairway* or *ramp* is by way of a vestibule, the door assembly into the vestibule shall be a *fire door assembly* complying with Section 716. The door assembly from the vestibule to the *stairway* shall have not less than a 20-minute *fire protection rating* complying with Section 716.~~

~~909.20.3.3 Vestibule ventilation.~~ ~~Each vestibule shall have a minimum net area of 16 square feet (1.5 m^2) of opening in a wall facing an outer *court*, *yard* or *public way* that is not less than 20 feet (6096 mm) in width.~~))

909.20.4 ((~~Mechanical ventilation alternative~~)) Reserved. ((~~The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of *smokeproof enclosures* by mechanical means.~~

~~909.20.4.1 Vestibule doors.~~ ~~The door assembly from the building into the vestibule shall be a *fire door assembly* complying with Section 716.2.2.1. The door assembly from the vestibule to the *stairway* or *ramp* shall not have less than a 20-minute *fire protection rating* and shall meet the requirements for a smoke door assembly in accordance with Section 716.2.2.1. The door shall be installed in accordance with NFPA 105.~~

~~909.20.4.2 Vestibule ventilation.~~ ~~The vestibule shall be supplied with not less than one air change per minute and the exhaust shall be not less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling *dampers* are permitted where necessary to meet the design requirements, but *dampers* are not otherwise required.~~

~~909.20.4.2.1 Engineered ventilation system.~~ ~~Where a specially engineered system is used, the system shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule in emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor-side entrance to each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with Section 907.3.~~

~~909.20.4.3 Smoke trap.~~ ~~The vestibule ceiling shall be not less than 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless *approved* and justified by design and test.~~

~~909.20.4.4 Stairway or ramp shaft air movement system.~~ ~~The *stairway* or *ramp shaft* shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the *shaft* relative to the vestibule with all doors closed.~~))

909.20.5 Stairway and ramp pressurization ((~~alternative~~)) for high-rise and underground buildings. Where ((~~the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, the vestibule is not required, provided that~~)) required by Section 403.5.4 or 405.7.2, each *interior exit stairway* or *ramp* ((~~is~~)) shall be pressurized to not less than 0.10 inch of water (25 Pa) and not more than 0.35 inches of water (87 Pa) in the *shaft* relative to the building measured with all *interior exit stairway* and *ramp* doors closed under maximum anticipated conditions of stack effect and wind effect. The pressure differential shall be measured between the *interior exit stairway* and the adjacent area. In residential buildings, the pressure differential is permitted to be measured between the *interior exit stairway* and the *dwelling units*.

Exceptions:

1. Positive pressure with respect to the elevator recall floor is required where elevator cars are at the floor of recall with the elevator doors open, but need not comply with the 0.10 inch of water minimum pressure differential.
2. The pressure differential is permitted to be measured relative to outdoor atmosphere on floors other than the following:
   2.1. The fire floor;
   2.2. The two floors immediately below the fire floor; and
   2.3. The floor immediately above the fire floor.

Interpretation I909.20.5: For the purposes of measuring pressure differentials, smoke zones consisting of floors interconnected by unenclosed vertical openings shall constitute a single floor.

909.20.5.1 Supply air. Air for stairway pressurization shall be supplied at intervals sufficient to maintain the required pressure throughout the interior exit stairway.

Note: The performance goal for Section 909.20.5.1 is compliance with minimum and maximum pressures at all levels of the shaft.

909.20.5.2 Supply air. Supply air shall be taken directly from an outside, uncontaminated source at least 20 feet (6096 mm) from any mechanical exhaust outlet and the dampered relief opening required by Section 909.20.5.3. The supply air intake shall be located at the exterior of the building. The intake shall be continuous to the exterior of the building. The fan system shall be equipped with two smoke detectors located in accordance with NFPA 72 arranged to automatically shut down the fan system only when both smoke detectors activate. The detectors shall be located downstream of the fan and shall be connected to the fire alarm as a supervisory signal.

Exception: The supply air intake need not be located 20 feet from the dampered relief outlet serving the same stairway.

Dampers other than motorized dampers required by the *International Energy Conservation Code* are not permitted in the stairway pressurization system air supply unless *approved* by the *building official*.

909.20.5.3 Dampered relief opening. The interior exit stairway shall be equipped with a relief opening at the top. The relief opening shall be equipped with a barometric relief damper and a motorized damper that complies with the *International Energy Conservation Code*. The motorized damper shall be of the normally open type (open with the power off). Activation of the damper shall be initiated by the building fire alarm system and by actuation of the *automatic sprinkler system.*

The pressurization system shall be capable of maintaining the differential pressure required by Section 909.20.5 while discharging 2,500 cubic feet per minute (1180 L/s) of air through the relief opening.

The relief outlet shall be located at least 20 feet from elevator hoistway and stairway pressurization system supply air intake locations.

Exception: The relief outlet need not be located 20 feet from the supply air intake for the stairway served by the relief outlet.

~~**((909.20.6 Pressurized stair and vestibule alternative.** The provisions of Sections 909.20.6.1 through 909.20.6.3 shall apply to *smokeproof enclosures* using a pressurized *stair* and pressurized entrance vestibule.~~

~~**909.20.6.1 Vestibule doors.** The door assembly from the building into the vestibule shall be a *fire door assembly* complying with Section 716.2.2.1. The door assembly from the vestibule to the *stairway* shall have not less than a 20-minute *fire protection rating* and meet the requirements for a smoke door assembly in accordance with Section 716.2.2.1. The door shall be installed in accordance with NFPA 105.~~

~~**909.20.6.2 Pressure difference.** The stair enclosure shall be pressurized to not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the vestibule with all *stairway* doors closed under the maximum anticipated stack pressures. The vestibule, with doors closed, shall have not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the fire floor. The pressure difference across doors shall not exceed 30 pounds (133 N) maximum force to begin opening the door.~~

~~**909.20.6.3 Dampered relief opening.** A controlled relief vent having the capacity to discharge not less than 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of the pressurized exit enclosure.~~

[S] ((~~909.20.7~~)) 909.20.5.4 ((~~Ventilating~~)) Activation of pressurization equipment. ((~~The activation of ventilating equipment required by the alternatives in Sections 909.20.4, 909.20.5 and 909.20.6 shall be by smoke detectors installed at each floor level at an *approved* location at the entrance to the *smokeproof enclosure*. When the closing device for the~~

~~*stairway* and *ramp shaft* and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels.~~)) The pressurization equipment required by Section 909.20.5 shall be activated by a fire alarm signal originating anywhere in the building. Smoke detectors shall be installed in accordance with Section 907.3. Activation of the pressurization equipment shall be independent of the position of any dampers in the stairway pressurization air supply system.

((~~909.20.7.1~~)) 909.20.5.5 ((~~Ventilation~~)) Independence of pressurization systems. ((~~*Smokeproof enclosure* ventilation~~)) Stairway pressurization systems shall be independent of other building ventilation systems.

Exception: Building ventilation systems, other than interior exit stairway supply air systems, are permitted to be used to exhaust air from adjacent space where necessary to maintain the differential pressure relationships. Building ventilation systems used to achieve stairway pressurization are not required to comply with Sections 909.10.1 and 909.11.3.

909.20.5.6 Protection of equipment. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the ((~~*smokeproof enclosure*~~)) interior exit stairway or connected to the ((~~*smokeproof enclosure*~~)) interior exit stairway by ductwork enclosed by ((~~not less than 2-hour~~)) *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the ((~~*smokeproof enclosure*~~)) interior exit stairway with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.
3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Exceptions:

1. Control wiring and power wiring located outside of a 2-hour fire barrier construction shall be protected using any one of the following methods:
   1.1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a *fire-resistance rating* of not less than 2 hours.
   1.2. Where encased with not less than 2 inches (51 mm) of concrete.
   1.3. *Electrical circuit protective systems* shall have a *fire-resistance rating* of not less than 2 hours. *Electrical circuit protective systems* shall be installed in accordance with their listing requirements.
2. Equipment, control wiring, power wiring, and ductwork serving building ventilation systems other than interior exit stairway supply air systems used to achieve the differential pressure relationships need not be protected.

((~~909.20.7.2~~)) 909.20.5.7 ((~~Standby~~)) Emergency power. ((~~Mechanical vestibule and *stairway* and *ramp shaft* ventilation~~)) Pressurization systems and automatic fire detection systems shall be provided with ((~~standby~~)) emergency power in accordance with Section 2702.

Interpretation I909.20.5.7: Building ventilation system fans used to achieve pressure differential relationships are considered to be part of the pressurization system and are required to be provided with emergency power.

((~~909.20.7.3 Acceptance and testing.~~ ~~Before the mechanical equipment is *approved*, the system shall be tested in the presence of the *building official* to confirm that the system is operating in compliance with these requirements.~~))

909.20.6 Stairway pressurization for low-rise buildings. Where stairway pressurization is provided in accordance with Section 1006.3.4 item 7 or Section 510.2 item 10, the pressurization system shall comply with the following:

1. Stairways shall be pressurized to a minimum positive pressure of 0.15 inch of water column (37 Pa) relative to the main occupied area on each floor, and a maximum pressure that complies with Section 1010.1.3.

Interpretation I909.20.6: For the purposes of measuring pressure differentials, smoke zones consisting of floors interconnected by unenclosed vertical openings shall constitute a single floor.

2. The stairway pressurization shall be activated by a fire alarm originating anywhere in the building.
3. Pressurization equipment and its duct work located within the building shall be separated from other portions of the building by construction equal to that required for the interior exit stairway.

4. Supply air shall be taken directly from an outside, uncontaminated source at least 20 feet (6096 mm) from any air exhaust system or outlet. Air ducts shall be continuous to the exterior of the building. Two smoke detectors shall be located in the duct in accordance with NFPA 72 arranged to automatically shut down the fan system only when both smoke detectors activate. The detectors shall be located downstream of the fan and shall be connected to the fire alarm as a supervisory signal.
5. A *legally required standby power system* shall be provided for the pressurization system according to Seattle Electrical Code Section 701. A connection ahead of the service disconnecting means shall be permitted as the sole source of power to the pressurization system.
6. Other measures to prevent loss of pressurization shall be provided in the design and construction of interior exit stairways, such as doors and door closers, quality of workmanship and caulking of penetrations and joints.
7. Stairway pressurization systems in low-rise buildings shall comply with Sections 909.2, 909.3, 909.10, 909.12, 909.13, 909.14, 909.17, 909.18, and 909.19 in addition to Section 909.20.6.

Note: A rational analysis complying with Section 909.4 is not required.

[S] 909.21 Elevator hoistway pressurization alternative. Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with Sections 909.21.1 through ((~~909.21.11~~)) 909.21.7.

909.21.1 Pressurization requirements. Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors closed. The pressure differentials shall be measured between the hoistway and the adjacent elevator landing. The opening and closing of hoistway doors at each level must be demonstrated during this test. ((~~The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.~~))

Exceptions:

1. On floors containing only Group R occupancies, the pressure differential is permitted to be measured between the hoistway and a *dwelling unit* or *sleeping unit*.
2. Where an elevator opens into a lobby enclosed in accordance with ((~~Section 3007.6 or 3008.6~~)) 403.6.1.5 or 403.6.2.6, the pressure differential is permitted to be measured between the hoistway and the space immediately outside the door(s) from the floor to the enclosed lobby.
3. The pressure differential is permitted to be measured relative to the outdoor atmosphere on floors other than the following:
   3.1. The fire floor.
   3.2. The two floors immediately below the fire floor.
   3.3. The floor immediately above the fire floor.
4. The minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to occupied floors are not required at the floor of recall with the doors open.
5. Subject to the approval of the *building official*, pressurization is not required for elevators in high-rise buildings with less than 75 feet (22 860 mm) from the lowest floor to the highest ceiling of the *stories* served by the elevator.
6. Maximum and minimum pressures are permitted to comply with rules promulgated by the *building official*.

Interpretation I909.21: For the purposes of measuring pressure differentials, smoke zones consisting of floors interconnected by unenclosed vertical openings shall constitute a single floor.

909.21.1.1 Supply air. The supply air shall be taken from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any mechanical exhaust outlet and dampered relief openings required by Section 909.20.5.3. The supply air intake may be located within the building provided it is located no more than 20 feet (6096 mm) from major openings in the building exterior such as loading docks and vehicular entrances. There shall be no obstruction to the flow of air to the intake.

Dampers other than motorized dampers required by the *International Energy Conservation Code* are not permitted in the elevator hoistway pressurization system air supply unless *approved* by the *building official*.

((~~909.21.1.1~~)) 909.21.1.2 Use of ventilation systems. Ventilation systems, other than hoistway supply air systems, are permitted to be used to exhaust air from adjacent spaces ((~~on the fire floor, two floors immediately below and one floor immediately above the fire floor~~)) to the building's exterior where necessary to maintain positive pressure relationships

as required in Section 909.21.1 during operation of the elevator *shaft* pressurization system. Ventilation systems used to achieve elevator hoistway pressurization are not required to comply with Section 909.21.4.

909.21.2 Rational analysis. A rational analysis complying with Section 909.4 shall be submitted with the *construction documents*.

Exception: A rational analysis is not required for elevator hoistway pressurization in low-rise buildings.

909.21.3 Ducts for system. Any duct system that is part of the pressurization system shall be protected with the same *fire-resistance rating* as required for the elevator *shaft* enclosure.

909.21.4 Fan system. The fan system provided for the pressurization system shall be as required by Sections 909.21.4.1 through 909.21.4.4.

909.21.4.1 Fire resistance. Where located within the building, the fan system that provides the pressurization shall be protected with the same *fire-resistance rating* required for the elevator ((~~*shaft*~~)) hoistway enclosure.

909.21.4.2 Smoke detection. The fan system shall be equipped with ((~~a~~)) two smoke detectors ((~~that will~~)) located in accordance with NFPA 72 arranged to automatically shut down the fan system only when both smoke detectors activate. ((~~is detected within the system.~~)) The detectors shall be located downstream of the fan and shall be connected to the fire alarm as a supervisory signal.

909.21.4.3 Separate systems. A separate fan system shall be used for each elevator hoistway.

909.21.4.4 Fan capacity. The ((~~supply~~)) fan system shall be ((~~either adjustable with a capacity of not less than 1,000 cubic feet per minute (0.4719 m^3/s) per door, or that specified by a *registered design professional* to meet the requirements of a designed pressurization system~~)) provided with the capacity to pressurize the elevator hoistway as determined by a registered design professional. The fan system shall be provided with a means to balance or modulate the airflow to the elevator hoistway to meet the differential pressure requirements on all floors for each condition identified by the rational analysis.

909.21.5 ((~~Standby~~)) Legally required standby and emergency power. Pressurization systems shall be powered by an *approved* emergency or *legally required standby power system*. ((~~The~~)) An *emergency power system* conforming to Section 909.11 shall be provided for pressurization systems in high-rise and underground buildings. Legally required standby power shall be provided ((~~with~~)) for the pressurization system in all other buildings. The emergency and legally required standby power shall be in accordance with Section 2702. For other than high-rise or underground buildings, connection ahead of the service disconnecting means in accordance with Seattle Electrical Code Section 701.12(E) is permitted as a source of legally required standby power.

909.21.6 Activation of pressurization system. The elevator pressurization system shall be activated upon activation of either the building fire alarm system or the elevator lobby smoke detectors. Where both a building fire alarm system and elevator lobby smoke detectors are present, each shall be independently capable of activating the pressurization system. Activation of the fan serving the hoistway is permitted to be delayed by up to 30 seconds so that elevator recall can be initiated prior to pressurizing the hoistway. Activation of the pressurization equipment shall be independent of the position of any dampers in the elevator hoistway air supply system.

Note: Activation of fans serving occupant evacuation elevators is allowed to be delayed, but the elevators must begin occupant evacuation activities and may not be immediately recalled.

((~~**909.21.7 Testing.** Testing for performance shall be required in accordance with Section 909.18.8. System acceptance shall be in accordance with Section 909.19.~~))

909.21.7 Machine and control rooms. Elevator machine and control rooms shall be pressurized in accordance with this section unless separated from the elevator hoistway by construction in accordance with Section 713.

((~~**909.21.8 Marking and identification.** Detection and control systems shall be marked in accordance with Section 909.14.~~

~~**909.21.9 Control diagrams.** Control diagrams shall be provided in accordance with Section 909.15.~~

~~**909.21.10 Control panel.** A control panel complying with Section 909.16 shall be provided.~~

~~**909.21.11 System response time.** Hoistway pressurization systems shall comply with the requirements for smoke control system response time in Section 909.17.~~))

SECTION 910
SMOKE AND HEAT REMOVAL

[F] 910.1 General. Where required by this code, smoke and heat vents or mechanical smoke removal systems shall conform to the requirements of this section.

910.4.1 Automatic sprinklers required. The building shall be equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1.

910.4.2 Exhaust fan construction. Exhaust fans that are part of a mechanical smoke removal system shall be rated for operation at 221°F (105°C). Exhaust fan motors shall be located outside of the exhaust fan air stream.

910.4.3 System design criteria. The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based on the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute (14.2 m^3/s).

910.4.3.1 Makeup air. Makeup air openings shall be provided within 6 feet (1829 mm) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of makeup air inlets shall be 8 square feet per 1,000 cubic feet per minute (0.74 m^2 per 0.4719 m^3/s) of smoke exhaust.

910.4.4 Activation. The mechanical smoke removal system shall be activated by manual controls only.

910.4.5 Manual control location. Manual controls shall be located where they are able to be accessed by the fire service from an exterior door of the building and separated from the remainder of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[S][F] 910.4.6 Control wiring. Wiring for operation and control of mechanical smoke removal systems shall be connected ahead of the main disconnect in accordance with Section 701.12E of ((~~NFPA 70~~)) the Seattle Electrical Code and be protected against interior fire exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes.

[F] 910.4.7 Controls. Where building air-handling and mechanical smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *International Mechanical Code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.

910.5 Maintenance. Smoke and heat vents and mechanical smoke removal systems shall be maintained in accordance with the *International Fire Code*.

SECTION 911
FIRE COMMAND CENTER

[F] 911.1 General. Where required by other sections of this code, in buildings classified as high-rise buildings by this code and in all F-1 and S-1 occupancies with a building footprint of over 500,000 square feet (46 452 m^2), a fire command center for fire department operations shall be provided and shall comply with Sections 911.1.1 through 911.1.7.

[F] 911.1.1 Location and access. The location and access to the fire command center shall be *approved* by the *fire code official*.

[W][F] 911.1.2 Separation. The fire command center shall be separated from the remainder of the building by not less than ((~~a 1~~)) one 2-hour *fire barrier* constructed in accordance with Section 707 or *horizontal assembly* constructed in accordance with Section 711, or both.

[F] 911.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m^2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater. Where a fire command is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m^2) in area, the fire command center shall have a minimum size of 96 square feet (9 m^2) with a minimum dimension of 8 feet (2348 mm) where *approved* by the *fire code official*.

[F] 911.1.4 Layout approval. A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation.

[F] 911.1.5 Storage. Storage unrelated to operation of the fire command center shall be prohibited.

[S][F] 911.1.6 Required features. The fire command center shall comply with NFPA 72 and shall contain all of the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system *annunciator*.
4. *Annunciator* unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.

6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking *interior exit stairway* doors simultaneously.
8. Sprinkler valve and waterflow detector display panels.
9. Emergency and legally required standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, *means of egress*, fire protection systems, fire fighter air replenishment system, fire-fighting equipment and fire department access and the location of *fire walls, fire barriers, fire partitions, smoke barriers* and *smoke partitions*.
13. An *approved* Building Information Card that contains, but is not limited to, the following information:
    - 13.1. General building information that includes: property name, address, the number of floors in the building above and below grade, use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor), and the estimated building population during the day, night and weekend.
    - 13.2. Building emergency contact information that includes: a list of the building's emergency contacts including but not limited to building manager and building engineer and their respective work phone number, cell phone number, e-mail address.
    - 13.3. Building construction information that includes: the type of building construction including but not limited to floors, walls, columns, and roof assembly.
    - 13.4. *Exit access* and *exit stairway* information that includes: number of *exit access* and *exit stairways* in the building, each *exit access* and *exit stairway* designation and floors served, location where each *exit access* and *exit stairway* discharges, *interior exit stairways* that are pressurized, *exit stairways* provided with emergency lighting, each *exit stairway* that allows reentry, *exit stairways* providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve; location of elevator machine rooms, control rooms and control spaces; location of sky lobby, location of freight elevator banks.
    - 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator, location of natural gas service.
    - 13.6. Fire protection system information that includes: location of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers, location of different types of *automatic sprinkler systems* installed including, but not limited to, dry, wet and pre-action.
    - 13.7 Hazardous material information that includes: location of hazardous material, quantity of hazardous material.
14. Work table.
15. Generator supervision devices, manual start and ((~~transfer~~)) stop features.
16. Public address system, where specifically required by other sections of this code.
17. Elevator fire recall switch in accordance with ASME A17.1/CSA B44.
18. Elevator emergency or legally required standby power selector switch(es), where emergency or standby power is provided.
19. On-site fire protection water tank fill-valve control switch, tank level indicators, tank low-level alarm and tank fill signal.

[F] 911.1.7 Fire command center identification. The *fire command center* shall be identified by a permanent easily visible sign reading "FIRE COMMAND CENTER" located on the door to the *fire command center*.

SECTION 912
FIRE DEPARTMENT CONNECTIONS

[F] 912.1 Installation. Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.6.

[S][F] 912.2 Location. With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be *approved* by the *fire code official*.

[F] 912.2.1 Visible location. Fire department connections shall be located on the ((~~street~~)) address side of buildings or facing approved fire apparatus access roads, fully visible and recognizable from the street, fire apparatus access road or nearest point of fire department vehicle access or as otherwise *approved* by the *fire code official*.

[F] 912.2.2 Existing buildings. On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an *approved* sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the *fire code official*.

912.2.3 High-rise buildings. Fire department connections for high-rise buildings shall be placed a distance apart not less than three-quarters of the length of the maximum overall diagonal dimension of the building served measured in a straight-line between the connections, or as otherwise approved by the *fire code official*.

[F] 912.3 Fire hose threads. Fire hose threads used in connection with standpipe systems shall be *approved* and shall be compatible with fire department hose threads.

[F] 912.4 Access. Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or moveable object. Access to fire department connections shall be *approved* by the *fire code official*.

Exception: Fences, where provided with an access gate equipped with a sign complying with the legend requirements of this section and a means of emergency operation. The gate and the means of emergency operation shall be *approved* by the *fire code official* and maintained operational at all times.

[F] 912.4.1 Locking fire department connection caps. The fire code official is authorized to require locking caps on fire department connections for water-based *fire protection systems* where the responding fire department carries appropriate key wrenches for removal.

[F] 912.4.2 Clear space around connections. A working space of not less than 36 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections, except as otherwise required or *approved* by the *fire code official*.

[F] 912.4.3 Physical protection. Where fire department connections are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312 of the *International Fire Code*.

[S][F] 912.5 Signs. A metal sign with raised letters not less than 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: "AUTOMATIC SPRINKLERS," "STANDPIPES," or "TEST CONNECTION," or a combination thereof as applicable per NFPA 14. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

[S] 912.5.1 Signs for high-rise buildings. An additional sign with letters at least 1 inch in size shall be provided at the fire department connections of high-rise buildings that indicate the building fire pump static (churn) discharge pressure. Where the pump is more than two *stories* above or below the fire department connections, the pump static/churn discharge pressure on the signage shall be adjusted to correct for the elevation difference.

[S][P] 912.6 Backflow protection. The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the ((~~*International*~~)) *Uniform Plumbing Code*.

SECTION 913
FIRE PUMPS

[F] 913.1 General. Where provided, fire pumps for fire protection systems shall be installed in accordance with this section and NFPA 20.

Exception: Pumps for automatic sprinkler systems installed in accordance with Section 903.3.1.3, or Section P2904 of the *International Residential Code*.

[F] 913.2 Protection against interruption of service. The fire pump, driver and controller shall be protected in accordance with NFPA 20 against possible interruption of service through damage caused by explosion, fire, *flood*, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions.

[W][S] 913.2.1 Protection of fire pump rooms. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour *fire barriers* constructed in accordance with Section 707 or 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

((~~**Exceptions:**~~

1. ~~In other than high-rise buildings, separation by 1-hour *fire barriers* constructed in accordance with Section 707 or 1-hour *horizontal assemblies* constructed in accordance with Section 711, or both, shall be permitted in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.~~
2. ~~Separation is not required for fire pumps physically separated in accordance with NFPA 20.~~))

[F] 913.2.2 Circuits supplying fire pumps. Cables used for survivability of circuits supplying fire pumps shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be *listed* in accordance with UL 2196 and shall have a *fire-resistance rating* of not less than 1 hour.
2. *Electrical circuit protective systems* shall have a *fire-resistance rating* of not less than 1 hour. *Electrical circuit protective systems* shall be installed in accordance with their listing requirements.
3. Construction having a *fire-resistance rating* of not less than 1 hour.
4. The cable or raceway is encased in a minimum of 2 inches (51 mm) of concrete.

Exception: This section shall not apply to cables, or portions of cables, located within a fire pump room or generator room which is separated from the remainder of the occupancy with *fire-resistance-rated* construction.

[F] 913.3 Temperature of pump room. Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (5°C).

[F] 913.3.1 Engine manufacturer's recommendation. Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer's recommendations for oil heaters shall be followed.

[F] 913.4 Valve supervision. Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

1. Central-station, proprietary or remote-station signaling service.
2. Local signaling service that will cause the sounding of an audible signal at a *constantly attended location*.
3. Locking valves open.
4. Sealing of valves and *approved* weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

[F] 913.4.1 Test outlet valve supervision. Fire pump test outlet valves shall be supervised in the closed position.

[F] 913.5 Acceptance test. Acceptance testing shall be done in accordance with the requirements of NFPA 20.

SECTION 914
EMERGENCY RESPONDER SAFETY FEATURES

[F] 914.1 Shaftway markings. Vertical *shafts* shall be identified as required by Sections 914.1.1 and 914.1.2.

[F] 914.1.1 Exterior access to shaftways. Outside openings accessible to the fire department and that open directly on a hoistway or shaftway communicating between two or more floors in a building shall be plainly marked with the word "SHAFTWAY" in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

[F] 914.1.2 Interior access to shaftways. Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word "SHAFTWAY" in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

Exception: Markings shall not be required on shaftway openings that are readily discernible as openings onto a shaftway by the construction or arrangement.

[F] 914.2 Equipment room identification. Fire protection equipment shall be identified in an *approved* manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves or other fire detection, suppression or control elements shall be identified for the use of the fire department. *Approved* signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

SECTION 915
CARBON MONOXIDE DETECTION

[F] 915.1 General. Carbon monoxide detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.6. Carbon monoxide detection shall be installed in existing buildings in accordance with Chapter 11 of the *International Fire Code*.

[W][F] 915.1.1 Where required. Carbon monoxide detection shall be provided in Group ((~~I-1, I-2, I-4~~)) I and R occupancies and in classrooms in Group E occupancies in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.

Exceptions:

1. R-2 occupancies, with the exception of R-2 college dormitories, are required to install carbon monoxide detectors without exception.
2. Sleeping units or *dwelling units* in I and R-1 occupancies and R-2 college dormitories, hotels, DOC prisons and work releases and DSHS licensed boarding home and residential treatment facility occupancies which do not themselves contain a fuel-burning appliance, a fuel-burning fireplace, or have an attached garage, need not be provided with carbon monoxide alarms provided that they comply with the exceptions of Section 915.1.4.

[F] 915.1.2 Fuel-burning appliances and fuel-burning fireplaces. Carbon monoxide detection shall be provided in *dwelling units, sleeping units* and classrooms that contain a fuel-burning appliance or a fuel-burning fireplace.

[F] 915.1.3 Fuel burning, forced-air furnaces. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms served by a fuel-burning, forced-air furnace.

Exception: Carbon monoxide detection shall not be required in *dwelling units, sleeping units* and classrooms if a carbon monoxide detector is provided in the first room or area served by each main duct leaving the furnace, and the carbon monoxide alarm signals are automatically transmitted to an approved location.

[F] 915.1.4 Fuel-burning appliances outside of dwelling units, sleeping units and classrooms. Carbon monoxide detection shall be provided in *dwelling units, sleeping units* and classrooms located in buildings that contain fuel-burning appliances or fuel-burning fireplaces.

Exceptions:

1. Carbon monoxide detection shall not be required in *dwelling units, sleeping units* and classrooms without communicating openings between the fuel-burning appliance or fuel-burning fireplace and the *dwelling unit, sleeping unit* or classroom.
2. Carbon monoxide detection shall not be required in *dwelling units, sleeping units* and classrooms where a carbon monoxide detector is provided in one of the following locations:
   2.1. In an *approved* location between the fuel-burning appliance or fuel-burning fireplace and the *dwelling unit, sleeping unit* or classroom.
   2.2. On the ceiling of the room containing the fuel-burning appliance or fuel-burning fireplace.

[F] 915.1.5 Private garages. Carbon monoxide detection shall be provided in *dwelling units, sleeping units* and classrooms in buildings with attached *private garages*.

Exceptions:

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the *private garage* and the *dwelling unit, sleeping unit* or classroom.
2. Carbon monoxide detection shall not be required in *dwelling units, sleeping units* and classrooms located more than one *story* above or below a *private garage*.
3. Carbon monoxide detection shall not be required where the *private garage* connects to the building through an *open-ended corridor*.
4. Where a carbon monoxide detector is provided in an *approved* location between openings to a *private garage* and *dwelling units, sleeping units* or classrooms.

[F] 915.1.6 Exempt garages. For determining compliance with Section 915.1.5, an *open parking garage* complying with Section 406.5 or an enclosed parking garage complying with Section 406.6 shall not be considered a *private garage*.

[W][F] 915.2 Locations. Where required by Section 915.1.1, carbon monoxide detection shall be installed in the locations specified in Sections 915.2.1 through 915.2.3.

[W][F] 915.2.1 Dwelling units. Carbon monoxide detection shall be installed in *dwelling units* outside of each separate sleeping area in the immediate vicinity of the bedrooms and on each level of the *dwelling*. Where a fuel-burning appliance

or a fuel-burning fireplace is located within a bedroom or its attached bathroom, carbon monoxide detection shall be installed within the bedroom.

[W][F] 915.2.2 Sleeping units. Carbon monoxide detection shall be installed in *sleeping units*.

Exception: Carbon monoxide detection shall be allowed to be installed outside of each separate sleeping area in the immediate vicinity of the *sleeping unit* where the *sleeping unit* or its attached bathroom does not contain a fuel-burning appliance or a fuel-burning fireplace and is not served by a forced air furnace.

[W][F] 915.2.3 Group E occupancies. ((~~Carbon~~)) When required by Section 915.1 in new buildings or by Chapter 11 of the International Fire Code, carbon monoxide ((~~detectors~~)) detection shall be installed in classrooms in Group E occupancies. Carbon monoxide alarm signals shall be automatically transmitted to an on-site location that is staffed by school personnel.

Exceptions:

1. Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies with an *occupant load* of ((~~30~~)) 50 or less.
2. Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies where an exception contained in Section 915.1 applies, or in Group E occupancies where signals are transmitted to an off-site service monitored by a third party, such as a service that monitors fire protection systems in the building.

[F] 915.3 Carbon monoxide detection. Carbon monoxide detection required by Sections 915.1 through 915.2.3 shall be provided by carbon monoxide alarms complying with Section 915.4 or carbon monoxide detection systems complying with Section 915.5.

[F] 915.4 Carbon monoxide alarms. Carbon monoxide alarms shall comply with Sections 915.4.1 through 915.4.4.

[F] 915.4.1 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than that required for overcurrent protection.

Exception: Where installed in buildings without commercial power, battery-powered carbon monoxide alarms shall be an acceptable alternative.

[F] 915.4.2 Listings. Carbon monoxide alarms shall be listed in accordance with UL 2034.

[F] 915.4.3 Locations. Carbon monoxide alarms shall only be installed in *dwelling units* and in *sleeping units*. They shall not be installed in locations where the code requires carbon monoxide detectors to be used.

[F] 915.4.4 Combination alarms. Combination carbon monoxide/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination carbon monoxide/smoke alarms shall be listed in accordance with UL 217 and UL 2034.

[W][F] 915.5 Carbon monoxide detection systems. Carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide alarms and shall comply with Sections 915.5.1 through 915.5.3.

[F] 915.5.1 General. Carbon monoxide detection systems shall comply with NFPA ((~~720~~)) 72. Carbon monoxide detectors shall be *listed* in accordance with UL 2075.

[F] 915.5.2 Locations. Carbon monoxide detectors shall be installed in the locations specified in Section 915.2. These locations supersede the locations specified in NFPA ((~~720~~)) 72.

[F] 915.5.3 Combination detectors. Combination carbon monoxide/smoke detectors installed in carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide detectors, provided that they are listed in accordance with UL 268 and UL 2075.

[F] 915.6 Maintenance. Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with the *International Fire Code*.

SECTION 916
GAS DETECTION SYSTEMS

[F] 916.1 Gas detection systems. Gas detection systems required by this code shall comply with Sections 916.2 through 916.11.

[F] 916.2 Permits. Permits shall be required as set forth in Section 105.6.10 of the *International Fire Code*.

[F] 916.2.1 Construction documents. Documentation of the gas detection system design and equipment to be used that demonstrates compliance with the requirements of this code and the *International Fire Code* shall be provided with the application for permit.

[F] 916.3 Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturer's instructions.

[F] 916.4 Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an unswitched receptacle using an *approved* restraining means that secures the plug to the receptacle.

[F] 916.5 Emergency and standby power. Standby or emergency power shall be provided or the gas detection system shall initiate a trouble signal at an *approved* location if the power supply is interrupted.

[F] 916.6 Sensor locations. Sensors shall be installed in *approved* locations where leaking gases are expected to accumulate.

[F] 916.7 Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except as follows:

1. For HPM gases, sample analysis shall be performed at intervals not exceeding 30 minutes.
2. For toxic gases that are not HPM, sample analysis shall be performed at intervals not exceeding 5 minutes in accordance with Section 6004.2.2.7 of the *International Fire Code*.
3. Where a less frequent or delayed sampling interval is *approved*.

[F] 916.8 System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the following thresholds:

1. For flammable gases, a gas concentration exceeding 25 percent of the lower flammability limit (LFL).
2. For nonflammable gases, a gas concentration exceeding one-half of the IDLH, unless a different threshold is specified by the section of this code requiring a gas detection system.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the section of this code requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

[F] 916.9 Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

[F] 916.10 Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturer's instructions.

[F] 916.11 Inspection, testing and sensor calibration. Gas detection systems and sensors shall be inspected, tested and calibrated in accordance with the *International Fire Code*.

SECTION 917
MASS NOTIFICATION SYSTEMS

[F] 917.1 College and university campuses. Prior to construction of a new building requiring a fire alarm system on a multiple-building college or university campus having a cumulative building *occupant load* of 1,000 or more, a mass notification risk analysis shall be conducted in accordance with NFPA 72. Where the risk analysis determines a need for mass notification, an *approved* mass notification system shall be provided in accordance with the findings of the risk analysis.

SECTION 918
EMERGENCY RESPONDER COMMUNICATION COVERAGE

[W][F] 918.1 General. In-building ((~~two-way~~)) emergency responder communication ((~~coverage~~)) enhancement system shall be provided in all new buildings in accordance with Section 510 of the *International Fire Code*.

CHAPTER 10

MEANS OF EGRESS

User notes:

About this chapter: *Chapter 10 provides the general criteria for designing the means of egress established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system (exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics that will permit the safe use of components without special knowledge or effort are specified.*

The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Chapter 10 is subdivided into four main sections: general (Sections 1003–1015), exit access (Sections 1016–1021), exit (Sections 1022–1027) and exit discharge (Sections 1028–1029). Special allowances for the unique requirements for assembly spaces (Section 1030) and emergency escape and rescue openings (Section 1031) complete the chapter. Chapter 10 of this code is duplicated in Chapter 10 of the International Fire Code®*; however, the* International Fire Code *contains one additional section on maintenance of the means of egress system in existing buildings.*

Section 1010 was extensively reorganized for the 2021 edition. For complete information, see the moved sections table in the preface information for the International Building Code*.*

SECTION 1001
ADMINISTRATION

1001.1 General. Buildings or portions thereof shall be provided with a *means of egress* system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of *means of egress* components required to provide an *approved means of egress* from structures and portions thereof.

1001.2 Minimum requirements. It shall be unlawful to alter a building or structure in a manner that will reduce the number of *exits* or the minimum width or required capacity of the *means of egress* to less than required by this code.

[F] SECTION 1002
MAINTENANCE AND PLANS

[F] 1002.1 Maintenance. *Means of egress* shall be maintained in accordance with the *International Fire Code*.

[F] 1002.2 Fire safety and evacuation plans. Fire safety and evacuation plans shall be provided for all occupancies and buildings where required by the *International Fire Code*. Such fire safety and evacuation plans shall comply with the applicable provisions of Sections 401.2 and 404 of the *International Fire Code*.

SECTION 1003
GENERAL MEANS OF EGRESS

1003.1 Applicability. The general requirements specified in Sections 1003 through 1015 shall apply to all three elements of the *means of egress* system, in addition to those specific requirements for the *exit access*, the *exit* and the *exit discharge* detailed elsewhere in this chapter.

[S] 1003.2 Ceiling height. The *means of egress* shall have a ceiling height of not less than 7 feet 6 inches (2286 mm) above the finished floor.

Exceptions:

1. ((~~Sloped ceilings~~)) Ceilings in accordance with Section 1208.2.

((~~2. Ceilings of *dwelling units* and *sleeping units* within residential occupancies in accordance with Section 1207.2.~~

~~3~~)) 2. Allowable projections in accordance with Section 1003.3.

((~~4~~)) 3. *Stair* headroom in accordance with Section 1011.3.

((~~5~~)) 4. Door height in accordance with Section 1010.1.1.

((~~6~~)) 5. *Ramp* headroom in accordance with Section 1012.5.2.

((~~7~~)) 6. The clear height of floor levels in vehicular and pedestrian traffic areas of public and private parking garages in accordance with Section 406.2.2.

((~~8~~)) 7. Areas above and below *mezzanine* floors in accordance with Section 505.2.

1003.3 Protruding objects. Protruding objects on *circulation paths* shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.

1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 where a minimum headroom of 80 inches (2032 mm) is provided over any circulation paths, including walks, *corridors*, *aisles* and passageways. Not more than 50 percent of the ceiling area of a *means of egress* shall be reduced in height by protruding objects.

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance above a *circulation path* is less than 80 inches (2032 mm) high above the finished floor. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the finished floor.

1003.3.2 Post-mounted objects. A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 4 inches (102 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the finished floor. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finished floor or ground.

Exception: These requirements shall not apply to sloping portions of *handrails* between the top and bottom riser of *stairs* and above the *ramp* run.

1003.3.3 Horizontal projections. Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finished floor shall not project horizontally more than 4 inches (102 mm) into the *circulation path*.

Exception: *Handrails* are permitted to protrude 4-1/2 inches (114 mm) from the wall or *guard*.

1003.3.4 Clear width. Protruding objects shall not reduce the minimum clear width of *accessible routes*.

1003.4 Slip-resistant surface. Circulation paths of the *means of egress* shall have a slip-resistant surface and be securely attached.

[S] 1003.5 Elevation change. Where changes in elevation of less than 12 inches (305 mm) exist in the *means of egress*, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5-percent slope), *ramps* complying with Section 1012 shall be used. Where the difference in elevation is 6 inches (152 mm) or less, the *ramp* shall be equipped with either *handrails* or floor finish materials that contrast with adjacent floor finish materials.

Exceptions:

1. Steps at exterior doors complying with Section 1010.1.4.
2. A *stair* with a single riser or with two risers and a tread is permitted at locations not required to be *accessible* by Chapter 11 and not within a stairway with two or more flights of stairs, where the risers and treads comply with Section 1011.5, the minimum depth of the tread is 13 inches (330 mm) and not less than one *handrail* complying with Section 1014 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the *stair*.
3. A step is permitted in *aisles* serving seating that has a difference in elevation less than 12 inches (305 mm) at locations not required to be *accessible* by Chapter 11, provided that the risers and treads comply with Section 1030.14 and the *aisle* is provided with a *handrail* complying with Section 1030.16.

Throughout a *story* in a Group I-2 occupancy, any change in elevation in portions of the *means of egress* that serve nonambulatory persons shall be by means of a *ramp* or sloped walkway.

1003.6 Means of egress continuity. The path of egress travel along a *means of egress* shall not be interrupted by a building element other than a *means of egress* component as specified in this chapter. Obstructions shall not be placed in the minimum width or required capacity of a *means of egress* component except projections permitted by this chapter. The minimum width or required capacity of a *means of egress* system shall not be diminished along the path of egress travel.

[W] 1003.7 Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required *means of egress* from any other part of the building.

Exceptions:

1. Elevators used as an *accessible* means of egress in accordance with Section 1009.4.
2. Escalators used as a means of egress for fixed transit and passenger rail system accordance with Section 3116.

SECTION 1004
OCCUPANT LOAD

1004.1 Design occupant load. In determining *means of egress* requirements, the number of occupants for whom *means of egress* facilities are provided shall be determined in accordance with this section.

Interpretation I1004.1: The occupant load factor for occupied roofs is 15 net unless the *construction documents* indicate use other than unconcentrated assembly.

1004.2 Cumulative occupant loads. Where the path of egress travel includes intervening rooms, areas or spaces, cumulative *occupant loads* shall be determined in accordance with this section.

1004.2.1 Intervening spaces or accessory areas. Where occupants egress from one or more rooms, areas or spaces through others, the design *occupant load* shall be the combined *occupant load* of interconnected accessory or intervening spaces. Design of egress path capacity shall be based on the cumulative portion of *occupant loads* of all rooms, areas or spaces to that point along the path of egress travel.

1004.2.2 Adjacent levels for mezzanines. That portion of the *occupant load* of a *mezzanine* with required egress through a room, area or space on an adjacent level shall be added to the *occupant load* of that room, area or space.

1004.2.3 Adjacent stories. Other than for the egress components designed for convergence in accordance with Section 1005.6, the *occupant load* from separate stories shall not be added.

1004.3 Multiple function occupant load. Where an area under consideration contains multiple functions having different *occupant load* factors, the design *occupant load* for such area shall be based on the floor area of each function calculated independently.

1004.4 Multiple occupancies. Where a building contains two or more occupancies, the *means of egress* requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same *means of egress* system, those egress components shall meet the more stringent requirements of all occupancies that are served.

1004.5 Areas without fixed seating. The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.5. For areas without *fixed seating*, the *occupant load* shall be not less than that number determined by dividing the floor area under consideration by the *occupant load* factor assigned to the function of the space as set forth in Table 1004.5. Where an intended function is not *listed* in Table 1004.5, the *building official* shall establish a function based on a *listed* function that most nearly resembles the intended function.

Exception: Where *approved* by the *building official*, the actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design *occupant load*.

1004.5.1 Increased occupant load. The *occupant load* permitted in any building, or portion thereof, is permitted to be increased from that number established for the occupancies in Table 1004.5, provided that all other requirements of the code are met based on such modified number and the *occupant load* does not exceed one occupant per 7 square feet (0.65 m2) of occupiable floor space. Where required by the *building official*, an *approved aisle*, seating or fixed equipment diagram substantiating any increase in *occupant load* shall be submitted. Where required by the *building official*, such diagram shall be posted.

[W][S] TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR[a]
Accessory storage areas, mechanical equipment room[b]	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Exhibit gallery and museum	30 net
Billiard table/game table	50 gross

[W][S] TABLE 1004.5—continued
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR[a]
Group M art gallery	30 gross
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	150 gross
Concentrated business use areas	See Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Commercial laboratories	100 gross
Day care	35 net
Dormitories	50 gross
Educational	
Classroom area	20 net
Shops, laboratories and other vocational room areas	50 net
Exercise rooms	50 gross
Fixed guideway transit and passenger rail systems	
Platform	See Section 3116
Concourse/lobby	100 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile	60 gross
Group M art gallery	30 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Floor area in square feet per occupant.

b. For electrical equipment areas, see also Sections 110.26 and 110.32 through 110.34 of the Seattle Electrical Code.

1004.6 Fixed seating. For areas having *fixed seats* and *aisles*, the *occupant load* shall be determined by the number of *fixed seats* installed therein. The *occupant load* for areas in which *fixed seating* is not installed, such as waiting spaces, shall be determined in accordance with Section 1004.5 and added to the number of *fixed seats*.

The *occupant load* of *wheelchair spaces* and the associated companion seat shall be based on one occupant for each *wheelchair space* and one occupant for the associated companion seat provided in accordance with Section 1109.2.3.

For areas having *fixed seating* without dividing arms, the *occupant load* shall be not less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The *occupant load* of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

1004.7 Outdoor areas. *Yards*, patios, occupied roofs, *courts* and similar outdoor areas accessible to and usable by the building occupants shall be provided with *means of egress* as required by this chapter. The *occupant load* of such outdoor areas shall be assigned by the *building official* in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, *means of egress* requirements for the building shall be based on the sum of the *occupant loads* of the building plus the outdoor areas.

Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one *means of egress*.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

1004.8 Concentrated business use areas. The *occupant load* factor for concentrated business use shall be applied to telephone call centers, trading floors, electronic data processing centers and similar business use areas with a higher density of occupants than would normally be expected in a typical business occupancy environment. Where approved by the *building official*, the *occupant load* for concentrated business use areas shall be the actual *occupant load*, but not less than one occupant per 50 square feet (4.65 m^2) of gross occupiable floor space.

1004.9 Posting of occupant load. Every room or space that is an assembly occupancy shall have the *occupant load* of the room or space posted in a conspicuous place, near the main *exit* or *exit access doorway* from the room or space, for the intended configurations. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or the owner's authorized agent.

SECTION 1005
MEANS OF EGRESS SIZING

[W] 1005.1 General. All portions of the *means of egress* system shall be sized in accordance with this section.

Exceptions:

1. *Aisles* and *aisle accessways* in rooms or spaces used for assembly purposes complying with Section 1030.
2. The capacity in inches, of means of egress components for fixed guideway transit and passenger rail stations, shall meet the requirements of Section 3116.

[S] 1005.2 Minimum width based on component. The minimum width, in inches (mm), of any *means of egress* components shall be not less than that specified for such component, elsewhere in this code. The width at any point in the path of egress travel shall not be less than the width required for doors in Section 1010.

Exceptions:

1. *Aisles* and *aisle accessways* complying with Section 1018.
2. Corridors complying with Section 1020.2.
3. Stage stairways and catwalks complying with Section 410.6.

1005.3 Required capacity based on occupant load. The required capacity, in inches (mm), of the *means of egress* for any room, area, space or *story* shall be not less than that determined in accordance with Sections 1005.3.1 and 1005.3.2.

1005.3.1 Stairways. The capacity, in inches, of means of egress *stairways* shall be calculated by multiplying the *occupant load* served by such *stairways* by a *means of egress* capacity factor of 0.3 inch (7.6 mm) per occupant. Where *stairways* serve more than one *story*, only the *occupant load* of each *story* considered individually shall be used in calculating the required capacity of the *stairways* serving that *story*.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of means of egress *stairways* shall be calculated by multiplying the *occupant load* served by such *stairways* by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant in buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an *emergency voice/alarm communication system* in accordance with Section 907.5.2.2.

2. Facilities with *smoke-protected assembly seating* shall be permitted to use the capacity factors in Table 1030.6.2 indicated for stepped *aisles* for *exit access* or exit *stairways* where the entire path for *means of egress* from the seating to the *exit discharge* is provided with a smoke control system complying with Section 909.
3. Facilities with *open-air assembly seating* shall be permitted to the capacity factors in Section 1030.6.3 indicated for stepped *aisles* for *exit access* or *exit stairways* where the entire path for *means of egress* from the seating to the *exit discharge* is open to the outdoors.

1005.3.2 Other egress components. The capacity, in inches, of *means of egress* components other than *stairways* shall be calculated by multiplying the *occupant load* served by such component by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of *means of egress* components other than *stairways* shall be calculated by multiplying the *occupant load* served by such component by a means of egress capacity factor of 0.15 inch (3.8 mm) per occupant in buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.
2. Facilities with *smoke-protected assembly seating* shall be permitted to use the capacity factors in Table 1030.6.2 indicated for level or ramped *aisles* for *means of egress* components other than *stairways* where the entire path for *means of egress* from the seating to the *exit discharge* is provided with a smoke control system complying with Section 909.
3. Facilities with *open-air assembly seating* shall be permitted to the capacity factors in Section 1030.6.3 indicated for level or ramped *aisles* for *means of egress* components other than *stairways* where the entire path for *means of egress* from the seating to the *exit discharge* is open to the outdoors.

1005.4 Continuity. The minimum width or required capacity of the *means of egress* required from any *story* of a building shall not be reduced along the path of egress travel until arrival at the *public way*.

1005.5 Distribution of minimum width and required capacity. Where more than one *exit*, or access to more than one *exit*, is required, the *means of egress* shall be configured such that the loss of any one *exit*, or access to one *exit*, shall not reduce the available capacity or width to less than 50 percent of the required capacity or width.

[S] 1005.6 Egress convergence. Where the *means of egress* from stories above and below converge at an intermediate level, the capacity of the *means of egress* from the point of convergence shall be not less than the largest minimum width or the sum of the required capacities for the *stairways* or *ramps* serving the two adjacent stories, whichever is larger.

Exception: The capacity necessary for parking uses need not be considered.

1005.7 Encroachment. Encroachments into the required *means of egress* width shall be in accordance with the provisions of this section.

1005.7.1 Doors. Doors, when fully opened, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half.

Exceptions:

1. Surface-mounted latch release hardware shall be exempt from inclusion in the 7-inch maximum (178 mm) encroachment where both of the following conditions exist:
   1.1. The hardware is mounted to the side of the door facing away from the adjacent wall where the door is in the open position.
   1.2. The hardware is mounted not less than 34 inches (865 mm) nor more than 48 inches (1219 mm) above the finished floor.
2. The restrictions on door swing shall not apply to doors within individual *dwelling units* and *sleeping units* of Group R-2 occupancies and *dwelling units* of Group R-3 occupancies.

1005.7.2 Other projections. *Handrail* projections shall be in accordance with the provisions of Section 1014.8. Other nonstructural projections such as *trim* and similar decorative features shall be permitted to project into the required width not more than 1-1/2 inches (38 mm) on each side.

Exception: Projections are permitted in *corridors* within Group I-2, Condition 1 in accordance with Section 407.4.3.

1005.7.3 Protruding objects. Protruding objects shall comply with the applicable requirements of Section 1003.3.

SECTION 1006
NUMBER OF EXITS AND EXIT ACCESS DOORWAYS

1006.1 General. The number of *exits* or *exit access doorways* required within the *means of egress* system shall comply with the provisions of Section 1006.2 for spaces, including *mezzanines*, and Section 1006.3 for *stories* or occupied roofs.

1006.2 Egress from spaces. Rooms, areas or spaces, including *mezzanines*, within a *story* or *basement* shall be provided with the number of *exits* or access to *exits* in accordance with this section.

[W] 1006.2.1 Egress based on occupant load and common path of egress travel distance. Two *exits* or *exit access doorways* from any space shall be provided where the design *occupant load* or the *common path of egress* travel distance exceeds the values *listed* in Table 1006.2.1. The cumulative *occupant load* from adjacent rooms, areas or spaces shall be determined in accordance with Section 1004.2.

Exceptions:

1. The number of *exits* from foyers, lobbies, vestibules or similar spaces need not be based on cumulative *occupant loads* for areas discharging through such spaces, but the capacity of the *exits* from such spaces shall be based on applicable cumulative *occupant loads*.
2. *Care suites* in Group I-2 occupancies complying with Section 407.4.
3. Unoccupied mechanical rooms and *penthouses* are not required to comply with the common path of egress travel distance measurement.
4. The common path of travel for fixed transit and passenger rail system stations shall be in accordance with Section 3116.

[W] 1006.2.1.1 Three or more exits or exit access doorways. Three *exits* or *exit access doorways* shall be provided from any space with an *occupant load* of 501 to 1,000. Four *exits* or *exit access doorways* shall be provided from any space with an *occupant load* greater than 1,000.

Exception: The number of required exits for fixed transit and passenger rail systems may be reduced by one at open stations.

[W] TABLE 1006.2.1
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)		
		Without Sprinkler System (feet)		With Sprinkler System (feet)
		Occupant Load		
		OL ≤ 30	OL > 30	
A[c], E, M[h]	49	75	75	75[a]
B	49	100	75	100[a]
F	49	75	75	100[a]
H-1, H-2, H-3	3	NP	NP	25[b]
H-4, H-5	10	NP	NP	75[b]
I-1, I-2[d], I-4	10	NP	NP	75[a]
I-3	10	NP	NP	100[a]
R-1	10	NP	NP	75[a]
R-2	20	NP	NP	125[a]
R-3[e]	20	NP	NP	125[a, g]
R-4[e]	20	NP	NP	125[a, g]
S[f]	29	100	75	100[a]
U	49	100	75	75[a]

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

a. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.

b. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.

c. For a room or space used for assembly purposes having fixed seating, see Section 1030.8.

d. For the travel distance limitations in Group I-2, see Section 407.4.

e. The common path of egress travel distance shall only apply in a Group R-3 occupancy located in a mixed occupancy building.

f. The length of common path of egress travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3, see Section 1006.2.2.6.

h. Day care facilities, rooms or spaces where care is provided for more than 10 children that are 2-1/2 years of age or less, shall have access to not less than two exits or exit access doorways.

1006.2.2 Egress based on use. The numbers, configuration and types of components of *exits* or access to *exits* shall be provided in the uses described in Sections 1006.2.2.1 through 1006.2.2.6.

1006.2.2.1 Boiler, incinerator and furnace rooms. Two *exit access doorways* are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m^2) and any fuel-fired equipment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two *exit access doorways* are required, one is permitted to be a fixed ladder or an *alternating tread device*. *Exit access doorways* shall be separated by a horizontal distance equal to one-half the length of the maximum overall diagonal dimension of the room.

1006.2.2.2 Refrigeration machinery rooms. Machinery rooms larger than 1,000 square feet (93 m^2) shall have not less than two *exits* or exit access doorways. Where two *exit access doorways* are required, one such doorway is permitted to be served by a fixed ladder or an *alternating tread device*. *Exit access doorways* shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of the room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an *exit* or *exit access doorway*. An increase in *exit access* travel distance is permitted in accordance with Section 1017.1.

Exit and *exit access doorways* shall swing in the direction of egress travel and shall be equipped with *panic hardware*, regardless of the *occupant load* served. Exit and *exit access doorways* shall be tight fitting and *self-closing*.

1006.2.2.3 Refrigerated rooms or spaces. Rooms or spaces having a floor area larger than 1,000 square feet (93 m^2), containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two *exits* or exit access doorways.

Exit access travel distance shall be determined as specified in Section 1017.1, but all portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an *exit* or *exit access doorway* where such rooms are not protected by an *approved automatic sprinkler system*. Egress is allowed through adjoining refrigerated rooms or spaces.

Exception: Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *International Mechanical Code*.

[S] 1006.2.2.4 Electrical rooms. The location and number of *exit* or *exit access doorways* shall be provided for electrical rooms in accordance with Section 110.26 of ((~~NFPA 70~~)) the *Seattle Electrical Code* for electrical equipment rated 1,000 volts or less, and Section 110.33 of ((~~NFPA 70~~)) the *Seattle Electrical Code* for electrical equipment rated over 1,000 volts. Panic hardware shall be provided where required in accordance with Section 1010.2.9.2.

Note: See *Seattle Electrical Code* Sections 110.26.C.2 and 110.33.A.1 for conditions where two exits shall be provided from required working space containing large equipment.

1006.2.2.5 Vehicular ramps. Vehicular *ramps* shall not be considered as an *exit access ramp* unless pedestrian facilities are provided.

[W] 1006.2.2.6 Groups R-3 and R-4. Where Group R-3 occupancies are permitted by Section 903.2.8 to be protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.3, the *exit access* travel distance for Group R-3 shall be not more than 125 feet (38 100 mm). Where Group R-4 occupancies are permitted by Section 903.2.8 to be protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.3, the *exit access* travel distance for Group R-4 shall be not more than 75 feet (22 860 mm).

[S] 1006.3 Egress from stories or occupied roofs. The *means of egress* system serving any *story* or occupied roof shall be provided with the number of separate and distinct *exits* or access to *exits* based on the aggregate *occupant load* served in accordance with this section. Horizontal exits shall not count toward the required number of exits from the *story* or roof.

1006.3.1 Occupant load. Where *stairways* serve more than one *story*, or more than one *story* and an occupied roof, only the *occupant load* of each *story* or occupied roof, considered individually, shall be used when calculating the required number of *exits* or access to *exits* serving that *story*.

Note: In high-rise buildings required to have an additional exit stairway by Section 403.5.2, all exit stairways must be accessible to all tenants on a floor without having to pass through another tenant space.

1006.3.2 Path of egress travel. The path of egress travel to an *exit* shall not pass through more than one adjacent *story*.

Exception: The path of egress travel to an *exit* shall be permitted to pass through more than one adjacent *story* in any of the following:

1. In Group R-1, R-2 or R-3 occupancies, *exit access stairways* and *ramps* connecting four stories or less serving and contained within an individual dwelling unit, sleeping unit or live/work unit.
2. *Exit access stairways* serving and contained within a Group R-3 congregate residence or a Group R-4 facility.
3. *Exit access stairways* and *ramps* within an *atrium* complying with Section 404.
4. *Exit access stairways* and *ramps* in *open parking garages* that serve only the parking garage.
5. *Exit access stairways* and *ramps* serving *open-air assembly seating* complying with the exit access travel distance requirements of Section 1030.7.
6. *Exit access stairways* and *ramps* between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, *places of religious worship*, auditoriums and sports facilities.
7. Exterior *exit access stairways* and *ramps* between occupied roofs.

1006.3.3 Egress based on occupant load. Each *story* and occupied roof shall have the minimum number of separate and distinct *exits*, or access to *exits*, as specified in Table 1006.3.3. A single *exit* or access to a single *exit* shall be permitted in accordance with Section 1006.3.4. The required number of *exits*, or *exit access stairways* or *ramps* providing access to *exits*, from any *story* or occupied roof shall be maintained until arrival at the *exit discharge* or a *public way*.

TABLE 1006.3.3
MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS PER STORY

OCCUPANT LOAD PER STORY	MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS FROM STORY
1-500	2
501-1,000	3
More than 1,000	4

[W][S] 1006.3.4 Single exits. A single *exit* or access to a single *exit* shall be permitted from any *story* or occupied roof where one of the following conditions exists:

1. The *occupant load*, number of *dwelling units* and exit access travel distance within the portion of the building served by the single exit do not exceed the values in Table 1006.3.4(1) or 1006.3.4(2).
2. Rooms, areas and spaces complying with Section 1006.2.1 with *exits* that discharge directly to the exterior at the *level of exit discharge*, are permitted to have one *exit* or access to a single *exit*.
3. Parking garages where vehicles are mechanically parked shall be permitted to have one *exit* or access to a single *exit*.
4. Group R-3 and R-4 occupancies shall be permitted to have one *exit* or access to a single *exit*.
5. Individual single-story or multistory *dwelling units* shall be permitted to have a single *exit* or access to a single *exit* from the *dwelling unit* provided that both of the following criteria are met:
   5.1. The *dwelling unit* complies with Section 1006.2.1 as a space with one *means of egress*.
   5.2. Either the exit from the *dwelling unit* discharges directly to the exterior at the *level of exit discharge*, or the *exit access* outside the *dwelling unit's* entrance door provides access to not less than two *approved* independent *exits*.
6. Occupied roofs with an occupant load of ten or less are permitted to have a single exit or access to a single exit.
7. Not more than 5 *stories* of Group R-2 occupancy are permitted to be served by a single exit under the following conditions:
   7.1. The building has not more than six *stories above grade plane*.
   7.2. The building does not contain a *boarding house*.
   7.3. There shall be no more than four *dwelling units* on any floor.
   7.4. The building shall be of not less than one hour fire-resistive construction and shall also be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. Residential-type sprinklers shall be used in all habitable spaces in each *dwelling unit*.
   7.5. There shall be no more than two single exit stairway conditions on the same property.
   7.6. An exterior stairway or interior exit stairway shall be provided. The interior exit stairway, including any related *exit passageway*, shall be pressurized in accordance with Section 909.20.6. Doors in the stairway shall swing into the interior exit stairway regardless of the occupant load served, provided that doors from the interior exit stairway to the building exterior are permitted to swing in the direction of exit travel.
   7.7. A *corridor* shall separate each *dwelling unit* entry/exit door from the door to an interior exit stairway, including any related *exit passageway*, on each floor. *Dwelling unit* doors shall not open directly into an interior exit stairway. *Dwelling unit* doors are permitted to open directly into an exterior stairway.

7.8. There shall be no more than 20 feet (6096 mm) of travel to the exit stairway from the entry/exit door of any dwelling unit.

7.9. Travel distance measured in accordance with Section 1017 shall not exceed 125 feet.

7.10. The exit shall not terminate in an egress *court* where the *court* depth exceeds the *court* width unless it is possible to exit in either direction to the public way.

7.11. Elevator hoistways shall be pressurized in accordance with Section 909.21 or shall open into elevator lobbies that comply with Section 713.14. Where *approved* by the *building official*, natural ventilation is permitted to be substituted for pressurization where the ventilation would prevent the accumulation of smoke or toxic gases.

7.12. Other occupancies are permitted in the same building provided they comply with all the requirements of this code. Other occupancies shall not communicate with the Group R occupancy portion of the building or with the single-exit stairway.

Exception: Parking garages and occupied roofs accessory to the Group R occupancy are permitted to communicate with the exit stairway.

7.13. The exit serving the Group R occupancy shall not discharge through any other occupancy, including an accessory parking garage.

7.14. There shall be no openings within 10 feet (3048 mm) of unprotected openings into the stairway other than required exit doors having a one-hour fire-resistance rating.

1006.3.4.1 Mixed occupancies. Where one *exit*, or *exit access stairway* or *ramp* providing access to exits at other stories, is permitted to serve individual *stories*, mixed occupancies shall be permitted to be served by single *exits* provided that each individual occupancy complies with the applicable requirements of Table 1006.3.4(1) or 1006.3.4(2) for that occupancy. Where applicable, cumulative *occupant loads* from adjacent occupancies shall be considered to be in accordance with the provisions of Section 1004.1. In each *story* of a mixed occupancy building, the maximum number of occupants served by a single exit shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occupants indicated in Table 1006.3.4(2) for each occupancy does not exceed one. Where *dwelling units* are located on a story with other occupancies, the actual number of *dwelling units* divided by four plus the ratio from the other occupancy does not exceed one.

TABLE 1006.3.4(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2[a, b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

TABLE 1006.3.4(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B[b], E, F[b], M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2[a, c]	10	75
	S[b, d]	29	75
Second story above grade plane	B, F, M, S[d]	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall have a maximum exit access travel distance of 100 feet.
c. This table is used for R-2 occupancies consisting of sleeping units. For R-2 occupancies consisting of dwelling units, use Table 1006.3.4(1).
d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

SECTION 1007
EXIT AND EXIT ACCESS DOORWAY CONFIGURATION

[S] 1007.1 General. *Exits*, *exit access doorways*, and *exit access stairways* and *ramps* serving spaces, including individual building *stories*, shall be separated in accordance with the provisions of this section. Interlocking or scissor stairs and stairways that share a wall with other exit stairways shall be counted as one exit or exit access.

1007.1.1 Two exits or exit access doorways. Where two *exits*, *exit access doorways*, *exit access stairways* or *ramps*, or any combination thereof, are required from any portion of the *exit access*, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between them. ((~~Interlocking or *scissor stairways* shall be counted as one *exit stairway.*~~))

Exceptions:

1. Where interior *exit stairways* or *ramps* are interconnected by a 1-hour fire-resistance-rated *corridor* conforming to the requirements of Section 1020, the required exit separation shall be measured along the shortest direct line of travel within the corridor.

Interpretation I1007.1: Exception 1 applies only where *corridors* have a one-hour fire-resistance-rating even where Section 1020 would allow non-rated *corridors*.

2. Where a building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance shall be not less than one-third of the length of the maximum overall diagonal dimension of the area served.
3. Where it is not practical to separate exits by one-half the diagonal dimension, exits from retail and office tenant spaces in Group B and M occupancies and within dwelling units shall be as far apart as reasonably practicable as determined by the building official.

Note: Interior exit stairways in high-rise buildings shall also meet the requirements of Section 403.5.1.

1007.1.1.1 Measurement point. The separation distance required in Section 1007.1.1 shall be measured in accordance with the following:

1. The separation distance to *exit* or *exit access doorways* shall be measured to any point along the width of the doorway.
2. The separation distance to *exit access stairways* shall be measured to any point along the width of the closest riser.
3. The separation distance to *exit access ramps* shall be measured to any point along the width of the start of the *ramp* run.

Interpretation I1007.1.1.1: In items 1 through 3, separation distance is permitted to be measured to the farthest point.

1007.1.2 Three or more exits or exit access doorways. Where access to three or more *exits* is required, not less than two *exit* or *exit access doorways* shall be arranged in accordance with the provisions of Section 1007.1.1. Additional required *exit* or *exit access doorways* shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available.

1007.1.3 Remoteness of exit access stairways or ramps. Where two *exit access stairways* or *ramps* provide the required *means of egress* to *exits* at another *story*, the required separation distance shall be maintained for all portions of such *exit access stairways* or *ramps*.

1007.1.3.1 Three or more exit access stairways or ramps. Where more than two *exit access stairways* or *ramps* provide the required *means of egress*, not less than two shall be arranged in accordance with Section 1007.1.3.

SECTION 1008
MEANS OF EGRESS ILLUMINATION

[S] 1008.1 Means of egress illumination. Illumination shall be provided at every point in the *means of egress* in accordance with Section 1008.2. Under emergency power, *means of egress* illumination shall comply with Section 1008.3.

1008.2 Illumination required. The *means of egress* serving a room or space shall be illuminated at all times that the room or space is occupied.

Exceptions:

1. Occupancies in Group U.
2. *Aisle accessways* in Group A.
3. *Dwelling units* and *sleeping units* in Groups R-1, R-2 and R-3.
4. *Sleeping units* of Group I occupancies.

[S] 1008.2.1 Illumination level under normal power. The *means of egress* illumination level shall be not less than 1 footcandle (11 lux) at the walking surface. Luminaires shall be installed whenever exit signs are required by Section 1013. Along *exit access stairways*, exit stairways and at their required landings, the illumination level shall not be less than 10 footcandles (108 lux) at the walking surface when the *stairway* is in use.

Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the walking surface is permitted to be reduced during performances by one of the following methods provided that the required illumination is automatically restored upon activation of a premises' *fire alarm system*:

1. Externally illuminated walking surfaces shall be permitted to be illuminated to not less than 0.2 footcandle (2.15 lux).
2. Steps, landings and the sides of *ramps* shall be permitted to be marked with *self-luminous* materials in accordance with Sections 1025.2.1, 1025.2.2 and 1025.2.4 by systems *listed* in accordance with UL 1994.

1008.2.2 Group I-2. In Group I-2 occupancies where two or more *exits* are required, on the exterior landings required by Section 1010.1.5, means of egress illumination levels for the exit discharge shall be provided such that failure of a single lamp in a luminaire shall not reduce the illumination level on that landing to less than 1 footcandle (11 lux).

Code Alternate CA1008.2: Compliance with the following paragraphs will be deemed to satisfy the requirement for means of egress illumination at every point in the means of egress. Means of egress illumination systems that comply with this Code Alternate shall also comply with Section 1008.3.

1. **Location and fixture placement.** Means of egress illumination shall be located in stairways, *corridor*s, halls, passenger elevator cars, lobbies, rooms with an occupant load of 100 or more, and other areas required to provide safe egress from the premises and immediately outside of the building exit when required by the *building official.* Fixtures shall be installed to not less than the following schedule:

1.1	Interior and exterior stairways and landings and outside building exit	At least one per landing
1.2	Corridors and halls and designated means of egress paths in parking garages	At least one for each 40 lineal feet
1.3	Lobbies, vestibules, foyers, elevator cars and other similar areas as required	At least one for each 250 square feet
1.4	Warehouses	See Item 2 below.

These fixtures are permitted to be included in the watts per square foot calculation for means of egress illumination.

2. **Amount of Illumination.** Where means of egress illumination is required, illumination shall be provided at the rate of 0.1 watts of fluorescent or 0.05 watts of LED illumination per square foot of area. Installations using incandescent lamps shall have a minimum wattage of at least 3 times the fluorescent requirements. Use of other light sources is subject to the approval of the *building official.*

Exceptions:

1. In warehouses, the allowable minimum illumination is permitted to be 0.1 watt per square foot (0.03 watts for fluorescent or 0.02 watts for LED) provided fixtures are placed either:
   - 1.1 Where means of egress pathways are not designated, fixtures shall be placed to cover an area not larger than 1,600 square feet, or
   - 1.2 Where means of egress pathways are designated, fixtures shall be placed at least one for every 40 lineal feet.
2. In theaters, auditoriums or other places of assembly where motion pictures or other projections are made by means of directed light, the minimum allowable illumination is permitted to be reduced to 0.05 watts per square foot of floor area (0.02 watts for fluorescent or 0.01 watts for LED). The higher level of required illumination shall be automatically restored upon activation of a premises fire alarm system where such system is provided.
3. In Groups B, F-1, M and S-1 occupancies, when *approved* by the *building official*, the minimum allowable illumination in the exit access is permitted to be reduced to 0.05 watts per square foot (0.02 watts for fluorescent or 0.01 watts for LED) of floor area.

[W] ((~~1008.2.3 Exit discharge.~~ ~~Illumination shall be provided along the path of travel for the exit discharge from each exit to the *public way*.~~

~~Exception:~~ ~~Illumination shall not be required where the path of the exit discharge meets both of the following requirements:~~

~~1. The path of exit discharge is illuminated from the exit to a safe dispersal area complying with Section 1028.5.~~

~~2. A dispersal area shall be illuminated to a level not less than 1 footcandle (11 lux) at the walking surface.~~))

[S] 1008.3 ((~~Emergency power~~)) Power supply for illumination. The power supply for *means of egress* illumination shall normally be provided by the premises' electrical supply.

1008.3.1 General. In the event of power supply failure in rooms and spaces that require two or more *exits* or access to exits, an emergency ((~~electrical~~)) power system shall automatically illuminate all of the following areas:

1. *Aisles*.
2. *Corridors*.
3. *Exit access stairways* and *ramps*.

1008.3.2 Buildings. In the event of power supply failure in buildings that require two or more *exits* or access to exits, an emergency electrical system shall automatically illuminate all of the following areas:

1. *Interior exit access stairways* and *ramps*.
2. *Interior* and *exterior exit stairways* and *ramps*.
3. *Exit passageways*.
4. Vestibules and areas on the level of discharge used for *exit discharge* in accordance with Section 1028.2.
5. Exterior landings as required by Section 1010.1.5 for *exit doorways* that lead directly to the *exit discharge*.

1008.3.3 Rooms and spaces. In the event of power supply failure, an emergency electrical system shall automatically illuminate all of the following areas:

1. Electrical equipment rooms.
2. Fire command centers.
3. Fire pump rooms.
4. Generator rooms.
5. Public restrooms with an area greater than 300 square feet (27.87 m^2).

1008.3.4 Duration. The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.

1008.3.5 Illumination level under emergency power. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 footcandle (11 lux) and a minimum at any point of 0.1 footcandle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle (6 lux) average and a minimum at any point of 0.06 footcandle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded. In Group I-2 occupancies, failure of a single lamp in a luminaire shall not reduce the illumination level to less than 0.2 footcandle (2.2 lux).

SECTION 1009
ACCESSIBLE MEANS OF EGRESS

[W] 1009.1 Accessible means of egress required. *Accessible* means of egress shall comply with this section. *Accessible* spaces shall be provided with not less than one accessible means of egress. Where more than one *means of egress* is required by Section 1006.2 or 1006.3 from any accessible space, each *accessible* portion of the space shall be served by not less than two accessible means of egress.

Exceptions:

1. Accessible means of egress are not required to be provided in existing buildings.

((~~1~~)) 2. One *accessible means of egress* is required from an *accessible mezzanine* level in accordance with Section 1009.3, 1009.4 or 1009.5.

((~~2~~)) 3. In assembly areas with ramped *aisles* or stepped *aisles*, one *accessible means of egress* is permitted where the *common path of egress travel* is *accessible* and meets the requirements in Section 1030.8.

4. In parking garages, accessible means of egress are not required to serve parking areas that do not contain accessible parking spaces.

[S] 1009.2 Continuity and components. Each required *accessible means of egress* shall be continuous to a *public way* and shall consist of one or more of the following components:

1. *Accessible routes* complying with Section 1104.
2. *Interior exit stairways* complying with Sections 1009.3 and 1023.
3. *Exit access stairways* complying with Sections 1009.3 and 1019.3 or 1019.4.
4. *Exterior exit stairways* complying with Sections 1009.3 and 1027 and serving levels other than the *level of exit discharge*.
5. Elevators complying with Section 1009.4.

Interpretation I1009.2a: An *exit passageway* is not required on the level of exit discharge to connect the elevator with the exterior exit door.

6. Platform lifts complying with Section 1009.5.
7. *Horizontal exits* complying with Section 1026.
8. *Ramps* complying with Section 1012.
9. *Areas of refuge* complying with Section 1009.6.
10. Exterior areas for assisted rescue complying with Section 1009.7 serving *exits* at the *level of exit discharge*.

[W][S] 1009.2.1 Elevators required. In buildings where a required accessible floor or accessible occupied roof is four or more stories above or below a *level of exit discharge*, not less than one required *accessible means of egress* shall be an elevator complying with Section 1009.4.

Interpretation I1009.2b: The level of exit discharge is not counted when determining whether an accessible floor is four *stories* above or below a level of exit discharge. See Figure 1009.2.b.

Exceptions:

1. In buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a *horizontal exit* and located at or above the *levels of exit discharge*.
2. In buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a *ramp* conforming to the provisions of Section 1012.

Interpretation I1009.2c: In exception 2, the ramp shall be part of an accessible *means of egress*.

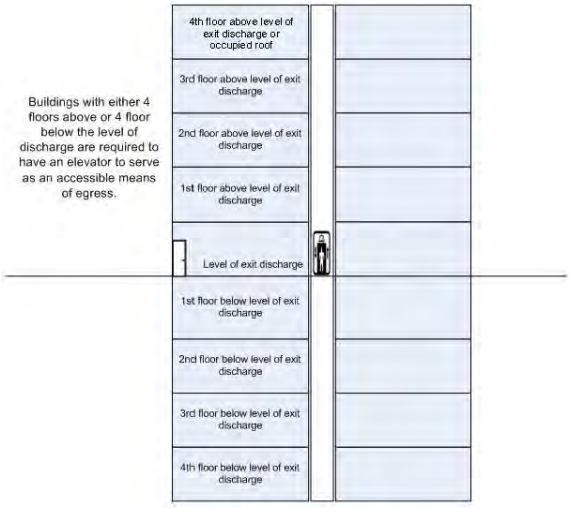


FIGURE 1009.2.b

1009.3 Stairways. In order to be considered part of an *accessible means of egress*, a *stairway* between *stories* shall comply with Sections 1009.3.1 through 1009.3.3.

1009.3.1 Exit access stairways. *Exit access stairways* that connect levels in the same *story* are not permitted as part of an *accessible means of egress*.

Exception: *Exit access stairways* providing *means of egress* from *mezzanines* are permitted as part of an *accessible means of egress*.

1009.3.2 Stairway width. *Stairways* shall have a clear width of 48 inches (1219 mm) minimum between *handrails*.

Exceptions:

1. The clear width of 48 inches (1219 mm) between *handrails* is not required in buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The clear width of 48 inches (1219 mm) between *handrails* is not required for *stairways* accessed from a refuge area in conjunction with a *horizontal exit*.

1009.3.3 Area of refuge. *Stairways* shall either incorporate an *area of refuge* within an enlarged floor-level landing or shall be accessed from an *area of refuge* complying with Section 1009.6.

Exceptions:

1. *Areas of refuge* are not required at *exit access stairways* where two-way communication is provided at the elevator landing in accordance with Section 1009.8.
2. *Areas of refuge* are not required at *stairways* in buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. *Areas of refuge* are not required at *stairways* serving *open parking garages*.
4. *Areas of refuge* are not required for *smoke-protected or open-air assembly seating* areas complying with Sections 1030.6.2 and 1030.6.3.
5. *Areas of refuge* are not required at *stairways* in Group R-2 occupancies.
6. *Areas of refuge* are not required for *stairways* accessed from a refuge area in conjunction with a *horizontal exit*.

1009.4 Elevators. In order to be considered part of an *accessible means of egress*, an elevator shall comply with Sections 1009.4.1 and 1009.4.2.

[S] 1009.4.1 Standby power. The elevator shall meet the emergency operation and signaling device requirements of Section 2.27 of ASME A17.1/CSA B44. ((~~Standby~~)) An emergency or *legally required standby* power *system* shall be provided in accordance with Chapter 27 and ((~~Section 3003~~)) the Seattle Electrical Code for the operation of the elevator, the shunt trip and lighting for elevator cars, control rooms, machine rooms, and machinery spaces.

1009.4.2 Area of refuge. The elevator shall be accessed from an *area of refuge* complying with Section 1009.6.

Exceptions:

1. *Areas of refuge* are not required at the elevator in *open parking garages*.
2. *Areas of refuge* are not required in buildings and facilities equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. *Areas of refuge* are not required at elevators not required to be located in a *shaft* in accordance with Section 712.
4. *Areas of refuge* are not required at elevators serving *smoke-protected or open-air assembly seating* areas complying with Sections 1030.6.2 and 1030.6.3.
5. *Areas of refuge* are not required for elevators accessed from a refuge area in conjunction with a *horizontal exit*.

[S] 1009.5 Platform lifts. Platform lifts shall be permitted to serve as part of an *accessible means of egress* where allowed as part of a required *accessible route* in Section 1110.9 except for Item 10. ((~~Standby~~)) A *legally required standby* power *system* for the platform lift shall be provided in accordance with Chapter 27.

1009.6 Areas of refuge. Every required *area of refuge* shall be accessible from the space it serves by an *accessible means of egress*.

1009.6.1 Travel distance. The maximum travel distance from any accessible space to an *area of refuge* shall not exceed the *exit access* travel distance permitted for the occupancy in accordance with Section 1017.1.

1009.6.2 Stairway or elevator access. Every required *area of refuge* shall have *direct access* to a *stairway* complying with Sections 1009.3 and 1023 or an elevator complying with Section 1009.4.

Exception: An interior area of refuge at the level of exit discharge that provides direct access to an exterior exit door.

1009.6.3 Size. Each *area of refuge* shall be sized to accommodate one *wheelchair space* of 30 inches by 52 inches (762 mm by 1320 mm) for each 200 occupants or portion thereof, based on the *occupant load* of the *area of refuge* and areas served

by the *area of refuge*. Such *wheelchair spaces* shall not reduce the *means of egress* minimum width or required capacity. Access to any of the required *wheelchair spaces* in an *area of refuge* shall not be obstructed by more than one adjoining *wheelchair space*.

1009.6.4 Separation. Each *area of refuge* shall be separated from the remainder of the *story* by a *smoke barrier* complying with Section 709 or a *horizontal exit* complying with Section 1026. Each *area of refuge* shall be designed to minimize the intrusion of smoke.

Exceptions:

1. *Areas of refuge* located within an enclosure for *interior exit stairways* complying with Section 1023.
2. *Areas of refuge* in outdoor facilities where *exit access* is essentially open to the outside.

1009.6.5 Two-way communication. *Areas of refuge* shall be provided with a two-way communication system complying with Sections 1009.8.1 and 1009.8.2.

1009.7 Exterior areas for assisted rescue. Exterior areas for assisted rescue shall be accessed by an *accessible route* from the area served.

Where the *exit discharge* does not include an *accessible route* from an exit located on the *level of exit discharge* to a *public way*, an exterior area of assisted rescue shall be provided on the exterior landing in accordance with Sections 1009.7.1 through 1009.7.4.

1009.7.1 Size. Each exterior area for assisted rescue shall be sized to accommodate *wheelchair spaces* in accordance with Section 1009.6.3.

1009.7.2 Separation. Exterior walls separating the exterior area of assisted rescue from the interior of the building shall have a minimum *fire-resistance rating* of 1 hour, rated for exposure to fire from the inside. The fire-resistance-rated *exterior wall* construction shall extend horizontally not less than 10 feet (3048 mm) beyond the landing on either side of the landing or equivalent fire-resistance-rated construction is permitted to extend out perpendicular to the *exterior wall* not less than 4 feet (1219 mm) on the side of the landing. The *fire-resistance-rated* construction shall extend vertically from the ground to a point not less than 10 feet (3048 mm) above the floor level of the area for assisted rescue or to the roof line, whichever is lower. Openings within such *fire-resistance-rated exterior walls* shall be protected in accordance with Section 716.

Exception: The *fire-resistance rating* and opening protectives are not required in the *exterior wall* where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.

1009.7.3 Openness. The exterior area for assisted rescue shall be open to the outside air. The sides other than the separation walls shall be not less than 50 percent open, and the open area shall be distributed so as to minimize the accumulation of smoke or toxic gases.

1009.7.4 Stairways. *Stairways* that are part of the *means of egress* for the exterior area for assisted rescue shall provide a minimum clear width of 48 inches (1219 mm) between *handrails*.

Exception: The minimum clear width of 48 inches (1219 mm) between *handrails* is not required at *stairways* serving buildings equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2.

[W] 1009.8 Two-way communication. A two-way communication system complying with Sections 1009.8.1 and 1009.8.2 shall be provided at the landing serving each elevator or bank of elevators on each accessible floor that is one or more stories above or below the *level of exit discharge*.

Exceptions:

1. Two-way communication systems are not required at the landing serving each elevator or bank of elevators where the two-way communication system is provided within *areas of refuge* in accordance with Section 1009.6.5.
2. Two-way communication systems are not required on floors provided with *ramps* that provide a direct path of egress travel to grade or the level of exit discharge conforming to the provisions of Section 1012.
3. Two-way communication systems are not required at the landings serving only service elevators that are not designated as part of the *accessible means of egress* or serve as part of the required *accessible route* into a facility.
4. Two-way communication systems are not required at the landings serving only freight elevators.
5. Two-way communication systems are not required at the landing serving a private residence elevator.
6. Two-way communication systems are not required in Group I-2 or I-3 facilities.

[W] 1009.8.1 System requirements. Two-way communication systems shall provide communication between each required location and the *fire command center* or a central control point location *approved* by the fire department. Where the central control point is not a *constantly attended location*, the two-way communication system shall have timed, automatic telephone dial-out capability that provides two-way communication with an approved supervising station. ((~~or 9-1-~~

~~1.~~)) The two-way communication system shall include both audible and visible signals. The two-way communication system shall have a battery backup or an *approved* alternate source of power that is capable of 90 minutes' use upon failure of the normal power source.

1009.8.2 Directions. Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system and written identification of the location shall be posted adjacent to the two-way communication system. Signage shall comply with the ICC A117.1 requirements for visual characters.

1009.9 Signage. Signage indicating special accessibility provisions shall be provided as shown:

1. Each door providing access to an *area of refuge* from an adjacent floor area shall be identified by a sign stating, "AREA OF REFUGE."
2. Each door providing access to an exterior area for assisted rescue shall be identified by a sign stating, "EXTERIOR AREA FOR ASSISTED RESCUE."

Signage shall comply with the ICC A117.1 requirements for visual characters and include the International Symbol of Accessibility. Where exit sign illumination is required by Section 1013.3, the signs shall be illuminated. Additionally, visual characters, raised character and braille signage complying with ICC A117.1 shall be located at each door to an *area of refuge* and exterior area for assisted rescue in accordance with Section 1013.4.

1009.10 Directional signage. Directional signage indicating the location of all other *means of egress* and which of those are *accessible* means of egress shall be provided at the following:

1. At *exits* serving a required accessible space but not providing an *approved accessible means of egress*.
2. At elevator landings.
3. Within *areas of refuge*.

1009.11 Instructions. In *areas of refuge* and exterior areas for assisted rescue, instructions on the use of the area under emergency conditions shall be posted. Signage shall comply with the ICC A117.1 requirements for visual characters. The instructions shall include all of the following:

1. Persons able to use the *exit stairway* do so as soon as possible, unless they are assisting others.
2. Information on planned availability of assistance in the use of *stairs* or supervised operation of elevators and how to summon such assistance.
3. Directions for use of the two-way communication system where provided.

SECTION 1010
DOORS, GATES AND TURNSTILES

[S] 1010.1 General. Doors in the *means of egress* shall comply with the requirements of Sections 1010.1.1 through 1010.3.4. Exterior *exit* doors shall also comply with the requirements of Section 1022.2. Gates in the *means of egress* shall comply with the requirements of Sections 1010.4 and 1010.4.1. Turnstiles in the *means of egress* shall comply with the requirements of Sections 1010.5 through 1010.5.4.

Doors, gates and turnstiles provided for egress purposes in numbers greater than required by this code shall comply with the requirements of this section. See Section 3201 for doors swinging over public property.

Doors in the *means of egress* shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on *means of egress* doors. *Means of egress* doors shall not be concealed by curtains, drapes, decorations or similar materials.

1010.1.1 Size of doors. The required capacity of each door opening shall be sufficient for the *occupant load* thereof and shall provide a minimum clear opening width of 32 inches (813 mm). The clear opening width of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear opening width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 32 inches (813 mm). In Group I-2, doors serving as means of egress doors where used for the movement of beds shall provide a minimum clear opening width of 41-1/2 inches (1054 mm). The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

Exceptions:

1. In Group R-2 and R-3 *dwelling and sleeping units* that are not required to be an *Accessible unit*, *Type A unit* or *Type B unit*, the minimum width shall not apply to door openings that are not part of the required *means of egress*.
2. In Group I-3, door openings to resident *sleeping units* that are not required to be an *Accessible unit* shall have a minimum clear opening width of 28 inches (711 mm).

1010.1.3.2 Manual horizontal sliding doors. Where a manual horizontal sliding door is required to latch, the latch or other mechanism shall prevent the door from rebounding into a partially open position when the door is closed.

[S] 1010.1.4 Floor elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

Exceptions:

1. At doors serving individual dwelling units or sleeping units in Groups R-2 and R-3: a door is permitted to open at the top step of ((~~an interior~~)) a *flight* of stairs, provided that the door does not swing over the top step.
2. At exterior doors serving Groups F, H, R-2 and S and where such doors are not part of an accessible route, the landing at an exterior door shall not be more than 7 inches (178 mm) below the landing on the egress side of the door, provided that the door, other than an exterior storm or screen door, does not swing over the landing.
3. At exterior doors serving Group U and individual dwelling units and sleeping units in Groups R-2 and R-3, and where such units are not required to be Accessible units, Type A units or Type B units, the landing at an exterior doorway shall be not more than 7-3/4 inches (197 mm) below the landing on the egress side of the door. Such doors, including storm or screen doors, shall be permitted to swing over either landing.
4. Variations in elevation due to differences in finish materials, but not more than 1/2 inch (12.7 mm).
5. Exterior decks, patios or balconies that are part of Type B *dwelling units* or sleeping units, that have impervious surfaces and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the *dwelling unit* or *sleeping unit*.
6. Doors serving equipment spaces not required to be *accessible* in accordance with Section 1103.2.9 and serving an *occupant load* of five or less shall be permitted to have a landing on one side to be not more than 7 inches (178 mm) above or below the landing on the egress side of the door.

[S] 1010.1.5 Landings at doors. Landings shall have a width not less than the width of the *stairway* or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). Where a landing serves an *occupant load* of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. When doors open over landings, doors in any position shall not reduce the landing length to less than 12 inches (305 mm). Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception: Landing length in the direction of travel in Groups R-3 and U and within individual units of Group R-2 need not exceed 36 inches (914 mm).

Interpretation I1010.1.5: Landing length, width and slope shall be measured as specified in Section 1011.6 and 1011.7.1. See Figures 1010.1.5(1), 1010.1.5(2) and 1010.1.5(3) for illustrations of the requirements of this section.

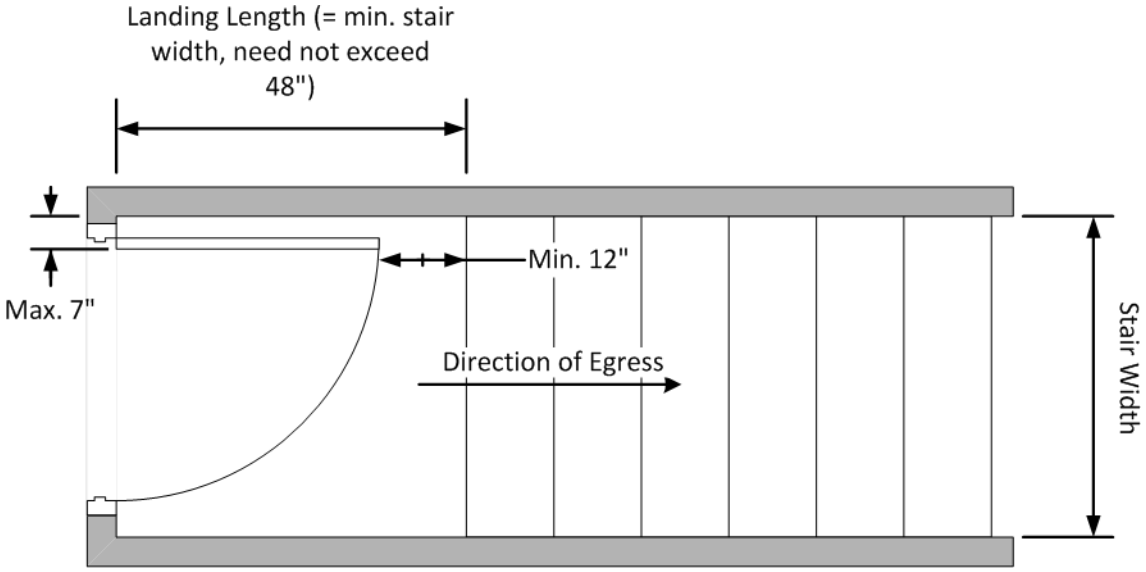


FIGURE 1010.1.5(1)
LANDING DIMENSIONS ONLY

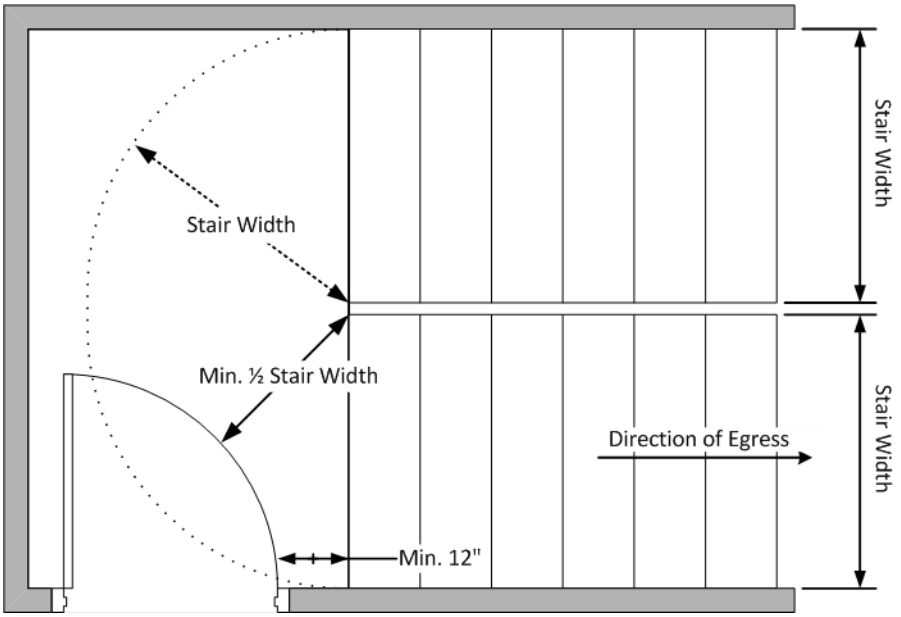


FIGURE 1010.1.5(2)
LANDING DIMENSIONS ONLY

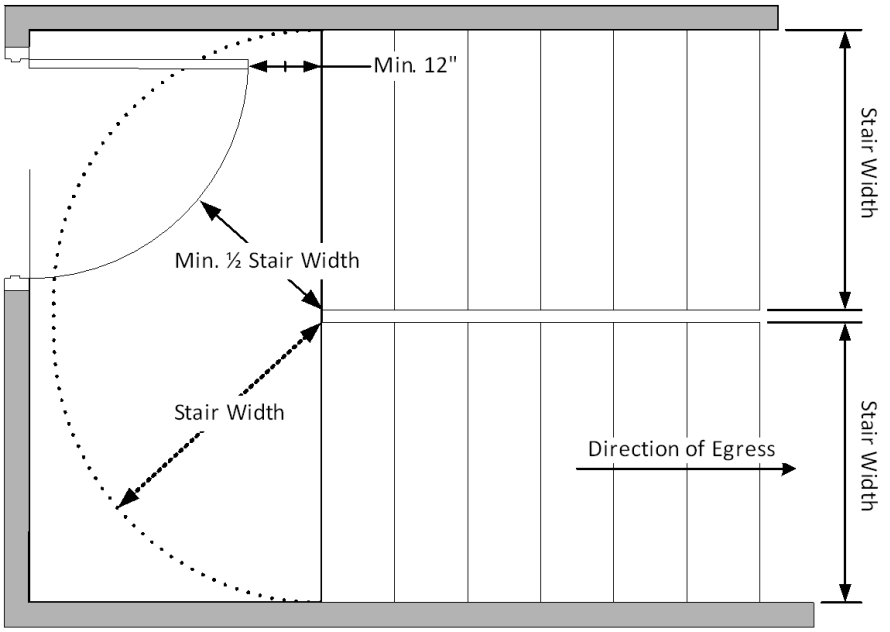


FIGURE 1010.1.5(3)
LANDING DIMENSIONS ONLY

1010.1.6 Thresholds. Thresholds at doorways shall not exceed 3/4 inch (19.1 mm) in height above the finished floor or landing for sliding doors serving *dwelling units* or 1/2 inch (12.7 mm) above the finished floor or landing for other doors. Raised thresholds and floor level changes greater than 1/4 inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope).

Exceptions:

1. In occupancy Group R-2 or R-3, threshold heights for sliding and side-hinged exterior doors shall be permitted to be up to 7-3/4 inches (197 mm) in height if all of the following apply:
    1.1. The door is not part of the required *means of egress*.

1.2. The door is not part of an *accessible route* as required by Chapter 11.

1.3. The door is not part of an *Accessible unit*, *Type A unit* or *Type B unit*.

2. In *Type B units*, where Exception 5 to Section 1010.1.4 permits a 4-inch (102 mm) elevation change at the door, the threshold height on the exterior side of the door shall not exceed 4-3/4 inches (120 mm) in height above the exterior deck, patio or balcony for sliding doors or 4-1/2 inches (114 mm) above the exterior deck, patio or balcony for other doors.

1010.1.7 Door arrangement. Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.

Exceptions:

1. The minimum distance between horizontal sliding *power-operated* doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual *dwelling units* in Groups R-2 and R-3 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual *dwelling units* in Groups R-2 and R-3 other than within Type A *dwelling units*.

[S] 1010.2 Door operations. Except as specifically permitted by this section, egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

Note: Stairway doors shall also comply with Section 1010.2.15.

1010.2.1 Unlatching. The unlatching of any door or leaf for egress shall require not more than one motion in a single linear or rotational direction to release all latching and all locking devices.

Exceptions:

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1010.2.5.
3. Doors with automatic flush bolts as permitted by Section 1010.2.4, Item 4.
4. Doors from individual *dwelling units* and *sleeping units* of Group R occupancies as permitted by Section 1010.2.4, Item 5.

1010.2.2 Hardware. Door handles, pulls, latches, locks and other operating devices on doors required to be *accessible* by Chapter 11 shall not require tight grasping, tight pinching or twisting of the wrist to operate.

1010.2.3 Hardware height. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Locks used only for security purposes and not used for normal operation are permitted at any height.

Exception: Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the latch release on self-latching devices at 54 inches (1370 mm) maximum above the finished floor or ground, provided that the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

[W][S] 1010.2.4 Locks and latches. Locks and latches shall be permitted to prevent operation of doors where any of the following exist:

1. Places of detention or restraint as *approved by the building official*.

((~~2. In Group I-1, Condition 2 and Group I-2 occupancies where the clinical needs of persons receiving care require containment or where persons receiving care pose a security threat, provided that all clinical staff can readily unlock doors at all times, and all such locks are keyed to keys carried by all clinical staff at all times or all clinical staff have the codes or other means necessary to operate the locks at all times.~~))

2. Approved, listed locks without delayed egress shall be permitted in Group I-1 condition 2 assisted living facilities licensed by the state of Washington, provided that:

2.1. The clinical needs of one or more patients require specialized security measures for their safety.

2.2. The doors unlock upon actuation of the automatic sprinkler system or automatic fire detection system.

2.3. The doors unlock upon loss of electrical power controlling the lock or lock mechanism.

2.4. The lock shall be capable of being deactivated by a signal from a switch located in an approved location.

2.5. There is a system, such as a keypad and code, in place that allows visitors, staff persons and appropriate residents to exit. Instructions for exiting shall be posted within six feet of the door.

3. In buildings in occupancy Group A having an *occupant load* of 300 or less, Groups B, F, M and S, and in *places of religious worship*, the main door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
   3.1. The locking device is readily distinguishable as locked.
   3.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED ((~~WHEN THIS SPACE IS OCCUPIED~~)) DURING BUSINESS HOURS. The sign shall be in letters 1 inch (25 mm) high on a contrasting background; ((~~.~~)) and
   3.3. The use of the key-operated locking device is revocable by the *building official* for due cause.
4. Where egress doors are used in pairs, *approved* automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush bolts does not have a doorknob or surface-mounted hardware on the egress side of the door.
5. Doors from individual *dwelling* or *sleeping units* of Group R occupancies having an *occupant load* of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.
6. *Fire doors* after the minimum elevated temperature has disabled the unlatching mechanism in accordance with *listed fire door* test procedures.
7. Doors serving roofs not intended to be occupied shall be permitted to be locked preventing entry to the building from the roof.
8. Other than egress *courts*, where occupants must egress from an exterior space through the building for *means of egress*, exit access doors shall be permitted to be equipped with an approved locking device where installed and operated in accordance with all of the following:
   8.1. The maximum *occupant load* shall be posted where required by Section 1004.9. Such signage shall be permanently affixed inside the building and shall be posted in a conspicuous space near all the exit access doorways.
   8.2. A weatherproof telephone or two-way communication system installed in accordance with Sections 1009.8.1 and 1009.8.2 shall be located adjacent to not less than one required exit access door on the exterior side.
   8.3. The egress door locking device is readily distinguishable as locked and shall be a key-operated locking device.
   8.4. A clear window or glazed door opening, not less than 5 square feet (0.46 m^2) in area, shall be provided at each exit access door to determine if there are occupants using the outdoor area.
   8.5. A readily visible, durable sign shall be posted on the interior side on or adjacent to each locked required exit access door serving the exterior area stating, "THIS DOOR TO REMAIN UNLOCKED WHEN THE OUTDOOR AREA IS OCCUPIED." The letters on the sign shall be not less than 1 inch (25.4 mm) high on a contrasting background.
   8.6. The *occupant load* of the occupied exterior area shall not exceed 300 occupants in accordance with Section 1004.
9. Locking devices are permitted on doors to balconies, decks or other exterior spaces serving individual dwelling or sleeping units.
10. Locking devices are permitted on doors to balconies, decks or other exterior spaces of 250 square feet (23.23 m^2) or less serving a private office space.
11. Doors from elevator lobbies providing access to exits are permitted to be locked during or after business hours where items 12.1 through 12.5 are satisfied.
    11.1. The lobby doors shall unlock automatically upon fire alarm.
    11.2. The lobby doors shall unlock automatically upon power loss.
    11.3. The alarm system shall include smoke detection in the elevator lobby and at least two detectors on the tenant side within 15 feet of the door;
    11.4. Access through the tenant portion of the building to both exits shall be unobstructed; and
    11.5. The building shall have an *automatic sprinkler system* throughout in accordance with Section 903.3.1.1 or 903.3.1.2.

[S] 1010.2.5 Bolt locks. Manually operated flush bolts or surface bolts are not permitted.

Exceptions:

1. On doors not required for egress in individual *dwelling units* or *sleeping units*.

2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts or self-latching flush bolts are permitted on the inactive leaf.
3. Where a pair of doors serves an *occupant load* of less than 50 persons in a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf. The inactive leaf shall not contain doorknobs, *panic* bars or similar operating hardware.
4. Where a pair of doors serves a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf provided that such inactive leaf is not needed to meet egress capacity requirements and the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. The inactive leaf shall not contain doorknobs, *panic* bars or similar operating hardware.
5. Where a pair of doors serves patient care rooms in Group I-2 occupancies, self-latching edge- or surface-mounted bolts are permitted on the inactive leaf provided that the inactive leaf is not needed to meet egress capacity requirements and the inactive leaf shall not contain doorknobs, *panic* bars or similar operating hardware.

1010.2.6 Closet doors. Closet doors that latch in the closed position shall be openable from inside the closet.

[S] 1010.2.7 Stairway doors. Interior *stairway* means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions:

1. *Stairway* discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. This section shall not apply to doors arranged in accordance with Section 403.5.3.
3. *Stairway* exit doors are permitted to be locked from the side opposite the egress side, provided that they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the *fire command center*, if present, or a signal by emergency personnel from a single location inside the main entrance to the building.
4. *Stairway exit* doors shall be openable from the egress side and shall only be locked from the opposite side in Group B, F, M and S occupancies where the only interior access to the tenant space is from a single *exit stairway* where permitted in Section 1006.3.4.
5. *Stairway* exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group R-2 occupancies where the only interior access to the *dwelling unit* is from a single exit *stairway* where permitted in Section 1006.3.4.
6. In stairways serving more than four *stories* in non-high-rise buildings, doors are permitted to be locked from the side opposite the egress side, provided they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the fire command center, if present, or a signal by emergency personnel from a single location inside the main entrance to the building. A communication system that complies with Section 403.5.3.1 shall be provided.

1010.2.8 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors from classrooms, offices and other occupied rooms with locking arrangements designed to keep intruders from entering the room shall comply with all of the following conditions:

1. The door shall be capable of being unlocked from outside the room with a key or other *approved* means.
2. The door shall be openable from within the room in accordance with Section 1010.2.
3. Modifications shall not be made to listed *panic hardware*, *fire door* hardware or door closers.
4. Modifications to *fire door assemblies* shall be in accordance with NFPA 80.

Remote locking or unlocking of doors from an approved location shall be permitted in addition to the unlocking operation in Item 1.

1010.2.9 Panic and fire exit hardware. Swinging doors serving a Group H occupancy and swinging doors serving rooms or spaces with an *occupant load* of 50 or more in a Group A or E occupancy shall not be provided with a latch or lock other than *panic hardware* or *fire exit hardware*.

Exceptions:

1. A main exit of a Group A occupancy shall be permitted to have locking devices in accordance with Section 1010.2.4, Item 3.
2. Doors provided with *panic hardware* or *fire exit hardware* and serving a Group A or E occupancy shall be permitted to be electrically locked in accordance with Section 1010.2.11 or 1010.2.12.
3. Exit access doors serving occupied exterior areas shall be permitted to be locked in accordance with Section 1010.2.4, Item 8.

4. Courtrooms shall be permitted to be locked in accordance with Section 1010.2.13, Item 3.

1010.2.9.1 Refrigeration machinery room. Refrigeration machinery rooms larger than 1,000 square feet (93 m^2) shall have not less than two exit or exit access doorways that swing in the direction of egress travel and shall be equipped with *panic hardware* or *fire exit hardware*.

1010.2.9.2 Rooms with electrical equipment. Exit or exit access doors serving transformer vaults, rooms designated for batteries or energy storage systems, or modular data centers shall be equipped with panic hardware or fire exit hardware. Rooms containing electrical equipment rated 800 amperes or more that contain overcurrent devices, switching devices or control devices and where the exit or exit access door is less than 25 feet (7620 mm) from the equipment working space as required by NFPA 70, such doors shall not be provided with a latch or lock other than *panic hardware* or *fire exit hardware*. The doors shall swing in the direction of egress travel.

1010.2.9.3 Installation. Where panic or *fire exit hardware* is installed, it shall comply with the following:

1. *Panic hardware* shall be *listed* in accordance with UL 305.
2. *Fire exit hardware* shall be *listed* in accordance with UL 10C and UL 305.
3. The actuating portion of the releasing device shall extend not less than one-half of the door leaf width.
4. The maximum unlatching force shall not exceed 15 pounds (67 N).

1010.2.9.4 Balanced doors. If *balanced doors* are used and *panic hardware* is required, the *panic hardware* shall be the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

1010.2.10 Monitored or recorded egress. Where electrical systems that monitor or record egress activity are incorporated, the locking system shall comply with Section 1010.2.11, 1010.2.12, 1010.2.13, 1010.2.14 or 1010.2.15 or shall be readily openable from the egress side without the use of a key or special knowledge or effort.

[S] 1010.2.11 Door hardware release of electrically locked egress doors. Door hardware release of electric locking systems shall be permitted on doors in the *means of egress* in any occupancy except Group H where installed and operated in accordance with all of the following:

1. The door hardware ((~~that~~)) is affixed to the door leaf and has an obvious method of operation that is readily operated under all lighting conditions.
2. The door hardware is capable of being operated with one hand without special knowledge, keys or tools, and shall comply with Section 1010.2.1.
3. Operation of the door hardware directly interrupts the power to the electric lock and unlocks the door immediately.
4. Loss of power to the electric locking system automatically unlocks the door.
5. Where *panic* or *fire exit hardware* is required by Section 1010.2.9, operation of the *panic* or *fire exit hardware* also releases the electric lock.
6. The locking system units shall be *listed* in accordance with UL 294.

1010.2.12 Sensor release of electrically locked egress doors. Sensor release of electric locking systems shall be permitted on doors located in the *means of egress* in any occupancy except Group H where installed and operated in accordance with all of the following criteria:

1. The sensor shall be installed on the egress side, arranged to detect an occupant approaching the doors, and shall cause the electric locking system to unlock.
2. The electric locks shall be arranged to unlock by a signal from or loss of power to the sensor.
3. Loss of power to the lock or locking system shall automatically unlock the electric locks.
4. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor and within 5 feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the electric lock—independent of other electronics—and the electric lock shall remain unlocked for not less than 30 seconds.
5. Activation of the building *fire alarm system*, where provided, shall automatically unlock the electric lock, and the electric lock shall remain unlocked until the *fire alarm system* has been reset.
6. Activation of the building *automatic sprinkler system* or fire detection system, where provided, shall automatically unlock the electric lock. The electric lock shall remain unlocked until the *fire alarm system* has been reset.
7. Emergency lighting shall be provided on the egress side of the door.
8. The door locking system units shall be *listed* in accordance with UL 294.

[S] 1010.2.13 Delayed egress. Delayed egress locking systems shall be permitted to be installed on doors serving the following occupancies in buildings that are equipped throughout with an *automatic sprinkler system* in accordance with

Section 903.3.1.1 or an *approved automatic smoke* or *heat detection system* installed in accordance with Section 907. Delayed egress locks are permitted in libraries in both Group A and E occupancies in locations other than at main exit doors, and in Group E day care occupancies.

1. Group B, F, I, M, R, S and U occupancies.
2. Group E classrooms with an *occupant load* of less than 50.
3. In courtrooms in Group A-3 and B occupancies, delayed egress locking systems shall be permitted to be installed on exit or *exit access* doors, other than the main exit or *exit access* door, in buildings that are equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

1010.2.13.1 Delayed egress locking system. The delayed egress locking system shall be installed and operated in accordance with all of the following:

1. The delay electronics of the delayed egress locking system shall deactivate upon actuation of the *automatic sprinkler system* or *automatic fire detection system*, allowing immediate free egress.
2. The delay electronics of the delayed egress locking system shall deactivate upon loss of power controlling the lock or lock mechanism, allowing immediate free egress.
3. The delayed egress locking system shall have the capability of being deactivated at the *fire command center* and other *approved* locations.
4. An attempt to egress shall initiate an irreversible process that shall allow such egress in not more than 15 seconds when a physical effort to exit is applied to the egress side door hardware for not more than 3 seconds. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the delay electronics have been deactivated, rearming the delay electronics shall be by manual means only.

   Exception: Where *approved*, a delay of not more than 30 seconds is permitted on a delayed egress door.
5. The egress path from any point shall not pass through more than one delayed egress locking system.

   Exceptions:

   1. In Group I-1, Condition 2, Group I-2 or I-3 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided that the combined delay does not exceed 30 seconds.
   2. In Group I-1, Condition 1 or Group I-4 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided the combined delay does not exceed 30 seconds and the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
6. A sign shall be provided on the door and shall be located above and within 12 inches (305 mm) of the door exit hardware:

   Exception: Where *approved*, in Group I occupancies, the installation of a sign is not required where care recipients who because of clinical needs require restraint or containment as part of the function of the treatment area.

   6.1. For doors that swing in the direction of egress, the sign shall read, "PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS."

   6.2. For doors that swing in the opposite direction of egress, the sign shall read, "PULL UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS."

   6.3. The sign shall comply with the visual character requirements in ICC A117.1.
7. Emergency lighting shall be provided on the egress side of the door.
8. The delayed egress locking system units shall be *listed* in accordance with UL 294.

[W][S] 1010.2.14 Controlled egress doors in Groups I-1 and I-2. Electric locking systems, including electro-mechanical locking systems and electromagnetic locking systems, shall be permitted to be locked in the *means of egress* in Group I-1 or I-2 occupancies where the clinical needs of persons receiving care require their containment. Controlled egress doors shall be permitted in such occupancies where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or an *approved automatic smoke detection system* installed in accordance with Section 907, provided that the doors are installed and operate in accordance with all of the following:

1. The door locks shall unlock on actuation of the *automatic sprinkler system* or *automatic smoke detection system*.
2. The door locks shall unlock on loss of power controlling the lock or lock mechanism.
3. The door locking system shall be installed to have the capability of being unlocked by a switch located at the *fire command center*, a nursing station or other *approved* location. The switch shall directly break power to the lock.

4. A building occupant shall not be required to pass through more than one door equipped with a ((~~controlled~~)) special egress locking system before entering an *exit*.
5. The procedures for unlocking the doors shall be described and *approved* as part of the emergency planning and preparedness required by Chapter 4 of the *International Fire Code*.

((~~6. All clinical staff shall have the keys, codes or other means necessary to operate the locking systems.~~))

6. There is a system, such as a keypad and code, in place that allows visitors, staff persons and appropriate residents to exit. Instructions for exiting shall be posted within six feet of the door.
7. Emergency lighting shall be provided at the door.
8. The door locking system units shall be *listed* in accordance with UL 294.

Exceptions:

1. Items 1 through 4, and 6, shall not apply to doors to areas ((~~occupied by~~)) where persons ((~~who~~)) which, because of clinical needs, require restraint or containment as part of the function of a psychiatric or cognitive treatment area provided that all clinical staff shall have the keys, codes or other means necessary to operate the locking devices.
2. Items 1 through 4, and 6, shall not apply to doors to areas where a *listed* egress control system is utilized to reduce the risk of child abduction from nursery and obstetric areas of a Group I-2 *hospital*.

1010.2.15 Locking arrangements in buildings within correctional facilities. In *buildings* within correctional and detention facilities, doors in *means of egress* serving rooms or spaces occupied by persons whose movements are controlled for security reasons shall be permitted to be locked where equipped with egress control devices that shall unlock manually and by not less than one of the following means:

1. Activation of an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.
2. Activation of an *approved manual fire alarm box*.
3. A signal from a *constantly attended location*.

1010.3 Special doors. Special doors and security grilles shall comply with the requirements of Sections 1010.3.1 through 1010.3.4.

1010.3.1 Revolving doors. Revolving doors shall comply with the following:

1. Revolving doors shall comply with BHMA A156.27 and shall be installed in accordance with the manufacturer's instructions.
2. Each revolving door shall be capable of *breakout* in accordance with BHMA A156.27 and shall provide an aggregate width of not less than 36 inches (914 mm).
3. A revolving door shall not be located within 10 feet (3048 mm) of the foot or top of *stairways* or escalators. A dispersal area shall be provided between the *stairways* or escalators and the revolving doors.
4. The revolutions per minute (rpm) for a revolving door shall not exceed the maximum rpm as specified in BHMA A156.27. Manual revolving doors shall comply with Table 1010.3.1(1). Automatic or *power-operated* revolving doors shall comply with Table 1010.3.1(2).
5. An emergency stop switch shall be provided near each entry point of power or automatic operated revolving doors within 48 inches (1219 mm) of the door and between 34 inches (864 mm) and 48 inches (1219 mm) above the floor. The activation area of the emergency stop switch button shall be not less than 1 inch (25 mm) in diameter and shall be red.
6. Each revolving door shall have a side-hinged swinging door that complies with Section 1010.1 in the same wall and within 10 feet (3048 mm) of the revolving door.
7. Revolving doors shall not be part of an *accessible route* required by Section 1009 and Chapter 11.

TABLE 1010.3.1(1)
MAXIMUM DOOR SPEED MANUAL REVOLVING DOORS

REVOLVING DOOR MAXIMUM NOMINAL DIAMETER (FT-IN)	MAXIMUM ALLOWABLE REVOLVING DOOR SPEED (RPM)
6-0	12
7-0	11
8-0	10
9-0	9
10-0	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The doors shall be openable by a simple method without special knowledge or effort from the egress side or sides.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable *fire protection rating* and, where rated, shall be *self-closing* or automatic closing by smoke detection in accordance with Section 716.2.6.6, shall be installed in accordance with NFPA 80 and shall comply with Section 716.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

1010.3.4 Security grilles. In Groups B, F, M and S, horizontal sliding or vertical security grilles are permitted at the main *exit* and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more exits or access to exits are required, not more than one-half of the *exits* or *exit access doorways* shall be equipped with horizontal sliding or vertical security grilles.

[W] 1010.3.4.1 Fixed transit and passenger rail systems. In fixed transit and passenger rail system stations, horizontal and vertical security grilles are permitted at station entrances as a component in the means of egress when the station is under constant supervision by on-site security personnel and an exit door with panic hardware that swings in the direction of egress, with a minimum clear width of 32 inches, provided within 10 feet of the gate. The security grilles shall remain secured in the full-open position during the period of occupancy by the general public.

1010.4 Gates. Gates serving the *means of egress* system shall comply with the requirements of this section. Gates used as a component in a *means of egress* shall conform to the applicable requirements for doors.

Exception: Horizontal sliding or swinging gates exceeding the 4-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

1010.4.1 Stadiums. *Panic hardware* is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet (0.28 m2) per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See Section 1028.5 for *means of egress* from safe dispersal areas.

1010.5 Turnstiles and similar devices. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required *means of egress*, except where permitted in accordance with Sections 1010.5.1, 1010.5.2 and 1010.5.3.

1010.5.1 Capacity. Each turnstile or similar device shall be credited with a capacity based on not more than a 50-person *occupant load* where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost and on the manual release by an employee in the area.
2. Such devices are not given credit for more than 50 percent of the required egress capacity or width.
3. Each device is not more than 39 inches (991 mm) high.
4. Each device has not less than 16-1/2 inches (419 mm) clear width at and below a height of 39 inches (991 mm) and not less than 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

1010.5.1.1 Clear width. Where located as part of an *accessible* route, turnstiles shall have not less than 36 inches (914 mm) clear width at and below a height of 34 inches (864 mm), not less than 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

1010.5.2 Security access turnstiles. Security access turnstiles that inhibit travel in the direction of egress utilizing a physical barrier shall be permitted to be considered as a component of the *means of egress*, provided that all of the following criteria are met:

1. The building is protected throughout by an approved, supervised *automatic sprinkler system* in accordance with Section 903.3.1.1.
2. Each security access turnstile lane configuration has a minimum clear passage width of 22 inches (559 mm).
3. Any security access turnstile lane configuration providing a clear passage width of less than 32 inches (810 mm) shall be credited with a maximum egress capacity of 50 persons.

4. Any security access turnstile lane configuration providing a clear passage width of 32 inches (810 mm) or more shall be credited with a maximum egress capacity as calculated in accordance with Section 1005.
5. Each secured physical barrier shall automatically retract or swing to an unobstructed open position in the direction of egress, under each of the following conditions:
   5.1. Upon loss of power to the turnstile or any part of the access control system that secures the physical barrier.
   5.2. Upon actuation of a clearly identified manual release device with ready access that results in direct interruption of power to each secured physical barrier, after which such barriers remain in the open position for not less than 30 seconds. The manual release device shall be positioned at one of the following locations:
      5.2.1. On the egress side of each security access turnstile lane.
      5.2.2. At an *approved* location where it can be actuated by an employee assigned to the area at all times that the building is occupied.
   5.3. Upon actuation of the building *fire alarm system*, if provided, after which the physical barrier remains in the open position until the *fire alarm system* is manually reset.

      Exception: Actuation of a manual fire alarm box.

   5.4. Upon actuation of the building automatic sprinkler system or fire detection system, after which the physical barrier remains in the open position until the *fire alarm system* is manually reset.

1010.5.3 High turnstile. Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors or the requirements of Section 1010.5.2 for security access turnstiles.

1010.5.4 Additional door. Where serving an *occupant load* greater than 300, each turnstile that is not portable shall have a side-hinged swinging door that conforms to Section 1010.1 within 50 feet (15 240 mm).

Exception: A side-hinged swinging door is not required at security access turnstiles that comply with Section 1010.5.2.

SECTION 1011
STAIRWAYS

[W] 1011.1 General. *Stairways* serving occupied portions of a building shall comply with the requirements of Sections 1011.2 through 1011.13. *Alternating tread devices* shall comply with Section 1011.14. Ship's ladders shall comply with Section 1011.15. Ladders shall comply with Section 1011.16.

Exceptions:

1. Within rooms or spaces used for assembly purposes, stepped *aisles* shall comply with Section 1030.
2. Stairways, alternating tread devices, ship's ladders, or ladders within an individual dwelling unit or sleeping unit used for egress from areas of 200 square feet (18.6 m^2) or less, and not containing the primary bathroom or kitchen, are exempt from the requirements of Section 1011. Such areas shall not be located more than 10 feet (3048 mm) above the finished floor of the space below.

[S] 1011.2 Width and capacity. The required capacity of *stairways* shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm). See Section 1009.3 for *accessible means of egress stairways*.

Exceptions:

1. *Stairways* serving an *occupant load* of less than 50 shall have a width of not less than 36 inches (914 mm).
2. *Spiral stairways* as provided for in Section 1011.10.
3. Where an incline platform lift or *stairway* chairlift is installed on *stairways* serving occupancies in Group R-3, or within *dwelling units* in occupancies in Group R-2, a clear passage width not less than 20 inches (508 mm) shall be provided. Where the seat and platform can be folded when not in use, the distance shall be measured from the folded position.
4. Stairways that are designed exclusively for circulation.

1011.3 Headroom. *Stairways* shall have a headroom clearance of not less than 80 inches (2032 mm) measured vertically from a line connecting the edge of the *nosings*. Such headroom shall be continuous above the *stairway* to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the *stairway* and landing.

Exceptions:

1. *Spiral stairways* complying with Section 1011.10 are permitted a 78-inch (1981 mm) headroom clearance.
2. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual *dwelling units* in Group R-2 occupancies; where the

nosings of treads at the side of a *flight* extend under the edge of a floor opening through which the *stair* passes, the floor opening shall be allowed to project horizontally into the required headroom not more than 4-3/4 inches (121 mm).

1011.4 Walkline. The walkline across *winder* treads shall be concentric to the direction of travel through the turn and located 12 inches (305 mm) from the side where the *winders* are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear *stair* width at the walking surface of the *winder*. Where *winders* are adjacent within the *flight*, the point of the widest clear *stair* width of the adjacent *winders* shall be used.

1011.5 Stair treads and risers. *Stair* treads and risers shall comply with Sections 1011.5.1 through 1011.5.5.3.

1011.5.1 Dimension reference surfaces. For the purpose of this section, all dimensions are exclusive of carpets, rugs or runners.

1011.5.2 Riser height and tread depth. *Stair* riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured vertically between the *nosings* of adjacent treads or between the *stairway* landing and the adjacent tread. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's *nosing*. *Winder* treads shall have a minimum tread depth of 11 inches (279 mm) between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the stair.

Exceptions:

1. *Spiral stairways* in accordance with Section 1011.10.
2. *Stairways* connecting stepped *aisles* to cross *aisles* or concourses shall be permitted to use the riser/tread dimension in Section 1030.14.2.
3. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual *dwelling units* in Group R-2 occupancies; the maximum riser height shall be 7-3/4 inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum *winder* tread depth at the walkline shall be 10 inches (254 mm); and the minimum *winder* tread depth shall be 6 inches (152 mm). A *nosing* projection not less than 3/4 inch (19.1 mm) but not more than 1-1/4 inches (32 mm) shall be provided on *stairways* with solid risers where the tread depth is less than 11 inches (279 mm).
4. See ((~~Section 503.1 of~~)) the *International Existing Building Code* for the replacement of existing *stairways*.
5. In Group I-3 facilities, *stairways* providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m^2) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).

1011.5.3 Winder treads. *Winder* treads are not permitted in *means of egress stairways* except within a *dwelling unit*.

Exceptions:

1. Curved *stairways* in accordance with Section 1011.9.
2. *Spiral stairways* in accordance with Section 1011.10.

1011.5.4 Dimensional uniformity. *Stair* treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed 3/8 inch (9.5 mm) in any *flight* of *stairs*. The greatest *winder* tread depth at the walkline within any *flight of stairs* shall not exceed the smallest by more than 3/8 inch (9.5 mm).

Exceptions:

1. *Stairways* connecting stepped *aisles* to cross *aisles* or concourses shall be permitted to comply with the dimensional nonuniformity in Section 1030.14.2.
2. Consistently shaped *winders*, complying with Section 1011.5, differing from rectangular treads in the same *flight* of *stairs*.
3. Nonuniform riser dimension complying with Section 1011.5.4.1.

[S] 1011.5.4.1 Nonuniform height risers. Where the bottom or top riser adjoins a sloping *public way*, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope. ((~~to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8 percent slope) of *stair* width. The *nosings* or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other *nosing* marking provided on the *stair flight*. The distinctive marking stripe shall be visible in descent of the *stair* and shall have a slip-resistant surface. Marking stripes shall have a width of not less than 1 inch (25 mm) but not more than 2 inches (51 mm).~~))

Exception: Spaces under *stairways* serving and contained within a single residential *dwelling unit* in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with 1/2-inch (12.7 mm) *gypsum board*.

1011.7.4 Enclosures under exterior stairways. There shall not be enclosed usable space under exterior exit *stairways* unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under exterior *stairways* shall not be used for any purpose.

[S] 1011.8 Vertical rise. A *flight* of *stairs* shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

Exceptions:

1. Spiral *stairways* used as a *means of egress* from *technical production areas*.
2. Stairways that are designed exclusively for circulation.

1011.9 Curved stairways. Curved *stairways* with *winder* treads shall have treads and risers in accordance with Section 1011.5 and the smallest radius shall be not less than twice the minimum width or required capacity of the stairway.

Exception: The radius restriction shall not apply to curved *stairways* in Group R-3 and within individual dwelling units in Group R-2.

[S] 1011.10 Spiral stairways. *Spiral stairways* are permitted to be used as a component in the *means of egress* only within *dwelling units* or from a space not more than 250 square feet (23 m^2) in area and serving not more than five occupants, ((~~or~~)) from *technical production areas* in accordance with Section 410.5 or as approved by the building official.

1. A *spiral stairway* shall have a 6-3/4-inch (171 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than 9-1/2 inches (241 mm). The minimum *stairway* clear width at and below the *handrail* shall be 26 inches (660 mm).
2. Spiral stairways are permitted to be used exclusively for circulation, provided:
   - 2.1. The spiral stairway connects any combination of the following: Group B occupancy, Group R occupancy, or Group A occupancies that are accessory to a Group R occupancy;
   - 2.2. It can be demonstrated that the occupants are unlikely to access the spiral stairway in an emergency;
   - 2.3. The required *means of egress* is clear and readily visible to occupants; and
   - 2.4. A placard is installed at the spiral stairway warning occupants that the spiral stairway is "NOT AN EXIT" in accordance with Section 1013.7.

1011.11 Handrails. *Flights of stairways* shall have *handrails* on each side and shall comply with Section 1014. Where glass is used to provide the *handrail*, the *handrail* shall comply with Section 2407.

Exceptions:

1. *Flights of stairways* within *dwelling units* and *flights of spiral stairways* are permitted to have a *handrail* on one side only.
2. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require *handrails*.
3. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require *handrails*.
4. Changes in room elevations of three or fewer risers within *dwelling units* and *sleeping units* in Groups R-2 and R-3 do not require *handrails*.
5. Where a platform lift is in a stationary position and the floor of the platform lift serves as the upper landing of a *stairway*, *handrails* shall not be required on the *stairway*, provided that all of the following criteria are met:
   - 5.1. The *stairway* contains not more than two risers.
   - 5.2. A handhold, positioned horizontally or vertically, is located on one side of the *stairway* adjacent to the top landing.
   - 5.3. The handhold is located not less than 34 inches (864 mm) and not more than 42 inches (1067 mm) above the bottom landing of the *stairway*.
   - 5.4. The handhold gripping surface complies with Section 1014.3, and is not less than 4.5 inches (114 mm) in length.

[S] 1011.12 Stairway to roof. In buildings four or more stories above grade plane, one *stairway* shall extend to the roof surface unless the roof has a slope steeper than four units vertical in 12 units horizontal (33-percent slope).

Exceptions:

1. Other than where required by Section 1011.12.1, in buildings without an occupied roof, access to the roof from the top *story* shall be permitted to be by an *alternating tread device* ((,)) or a ships ladder. ((~~or a permanent ladder.~~))
2. Access to the roof is not required in Group R-3 occupancies.

1011.12.1 Stairway to elevator equipment. Roofs and *penthouses* containing elevator equipment that must be accessed for maintenance are required to be accessed by a *stairway*.

1011.12.2 Roof access. Where a *stairway* is provided to a roof, access to the roof shall be provided through a *penthouse* complying with Section 1511.2.

Exception: In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m^2) in area and having a minimum dimension of 2 feet 6 inches (((~~610~~)) 762 mm).

1011.13 Guards. *Guards* shall be provided along *stairways* and landings where required by Section 1015 and shall be constructed in accordance with Section 1015. Where the roof hatch opening providing the required access is located within 10 feet (3049 mm) of the roof edge, such roof access or roof edge shall be protected by *guards* installed in accordance with Section 1015.

1011.14 Alternating tread devices. *Alternating tread devices* are limited to an element of a *means of egress* in buildings of Groups F, H and S from a *mezzanine* not more than 250 square feet (23 m^2) in area and that serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m^2) in area and for access to unoccupied roofs. *Alternating tread devices* used as a *means of egress* shall not have a rise greater than 20 feet (6096 mm) between floor levels or landings.

1011.14.1 Handrails of alternating tread devices. *Handrails* shall be provided on both sides of *alternating tread devices* and shall comply with Section 1014.

1011.14.2 Treads of alternating tread devices. *Alternating tread devices* shall have a minimum tread depth of 5 inches (127 mm), a minimum projected tread depth of 8-1/2 inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9-1/2 inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception: *Alternating tread devices* used as an element of a *means of egress* in buildings from a *mezzanine* area not more than 250 square feet (23 m^2) in area that serves not more than five occupants shall have a minimum tread depth of 3 inches (76 mm) with a minimum projected tread depth of 10-1/2 inches (267 mm). The rise to the next alternating tread surface shall not exceed 8 inches (203 mm).

1011.15 Ship's ladders. Ship's ladders are permitted to be used in Group I-3 as a component of a *means of egress* to and from control rooms or elevated facility observation stations not more than 250 square feet (23 m^2) with not more than three occupants and for access to unoccupied roofs. The minimum clear width at and below the *handrails* shall be 20 inches (508 mm). Ship's ladders shall be designed for the live loads indicated in Section 1607.17.

1011.15.1 Handrails of ship's ladders. *Handrails* shall be provided on both sides of ship's ladders.

1011.15.2 Treads of ship's ladders. Ship's ladders shall have a minimum tread depth of 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the *nosing* projection is not less than 8-1/2 inches (216 mm). The maximum riser height shall be 9-1/2 inches (241 mm).

1011.16 Ladders. Permanent ladders shall not serve as a part of the *means of egress* from occupied spaces within a building. Permanent ladders shall be constructed in accordance with Section 306.5 of the *International Mechanical Code* and designed for the live loads indicated in Section 1607.17. Permanent ladders shall be permitted to provide access to the following areas:

1. Spaces frequented only by personnel for maintenance, repair or monitoring of equipment.
2. Nonoccupiable spaces accessed only by catwalks, crawl spaces, freight elevators or very narrow passageways.
3. Raised areas used primarily for purposes of security, life safety or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers or lifeguard stands.
4. Elevated levels in Group U not open to the general public.
5. Nonoccupied roofs that are not required to have *stairway* access in accordance with Section 1011.12.1.
6. Where permitted to access equipment and appliances in accordance with Section 306.5 of the *International Mechanical Code*.

SECTION 1012
RAMPS

[W] 1012.1 Scope. The provisions of this section shall apply to *ramps* used as a component of a *means of egress*.

Exceptions:

1. Ramped *aisles* within assembly rooms or spaces shall comply with the provisions in Section 1030.13.
2. Curb ramps shall comply with ICC A117.1.
3. Vehicle ramps in parking garages for pedestrian *exit access* shall not be required to comply with Sections 1012.3 through 1012.10 where they are not an *accessible* route serving accessible parking spaces, other required accessible elements or part of an *accessible means of egress*.
4. In a parking garage where one accessible *means of egress* serving accessible parking spaces or other accessible elements is provided, a second accessible *means of egress* serving that area shall be permitted to include a vehicle ramp that does not comply with Sections 1012.4, 1012.5 and 1012.8. A landing complying with Sections 1012.6.1 and 1012.6.4 shall be provided at any change of direction in the accessible *means of egress*.

1012.2 Slope. *Ramps* used as part of a *means of egress* shall have a running slope not steeper than 1 unit vertical in 12 units horizontal (8.3-percent slope). The slope of other pedestrian *ramps* shall not be steeper than 1 unit vertical in 8 units horizontal (12.5-percent slope).

1012.3 Cross slope. The slope measured perpendicular to the direction of travel of a *ramp* shall not be steeper than one unit vertical in 48 units horizontal (2-percent slope).

1012.4 Vertical rise. The rise for any *ramp* run shall be 30 inches (762 mm) maximum.

1012.5 Minimum dimensions. The minimum dimensions of *means of egress ramps* shall comply with Sections 1012.5.1 through 1012.5.3.

1012.5.1 Width and capacity. The minimum width and required capacity of a *means of egress ramp* shall be not less than that required for *corridors* by Section 1020.3. The clear width of a *ramp* between *handrails*, if provided, or other permissible projections shall be 36 inches (914 mm) minimum.

1012.5.2 Headroom. The minimum headroom in all parts of the *means of egress ramp* shall be not less than 80 inches (2032 mm) above the finished floor of the *ramp* run and any intermediate landings. The minimum clearance shall be maintained for the full width of the *ramp* and landing.

1012.5.3 Restrictions. *Means of egress ramps* shall not reduce in width in the direction of egress travel. Projections into the required *ramp* and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

1012.6 Landings. *Ramps* shall have landings at the bottom and top of each *ramp*, points of turning, entrance, *exits* and at doors. Landings shall comply with Sections 1012.6.1 through 1012.6.5.

1012.6.1 Slope. Landings shall have a slope not steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.

1012.6.2 Width. The landing width shall be not less than the width of the widest *ramp* run adjoining the landing.

1012.6.3 Length. The landing length shall be 60 inches (1525 mm) minimum.

Exceptions:

1. In Group R-2 and R-3 individual dwelling and *sleeping units* that are not required to be *Accessible units*, *Type A units* or *Type B units* in accordance with Section 1108, landings are permitted to be 36 inches (914 mm) minimum.
2. Where the *ramp* is not a part of an *accessible* route, the length of the landing shall not be required to be more than 48 inches (1219 mm) in the direction of travel.

1012.6.4 Change in direction. Where changes in direction of travel occur at landings provided between *ramp* runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

Exception: In Group R-2 and R-3 individual *dwelling* or *sleeping units* that are not required to be *Accessible units*, *Type A units* or *Type B units* in accordance with Section 1108, landings are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

1012.6.5 Doorways. Where doorways are located adjacent to a *ramp* landing, maneuvering clearances required by *ICC A117.1* are permitted to overlap the required landing area.

1012.7 Ramp construction. *Ramps* shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood *handrails* shall be permitted for all types of construction.

1012.7.1 Ramp surface. The surface of *ramps* shall be of slip-resistant materials that are securely attached.

1012.7.2 Outdoor conditions. Outdoor *ramps* and outdoor approaches to *ramps* shall be designed so that water will not accumulate on walking surfaces.

1012.8 Handrails. *Ramps* with a rise greater than 6 inches (152 mm) shall have *handrails* on both sides. *Handrails* shall comply with Section 1014.

1012.9 Guards. *Guards* shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015.

1012.10 Edge protection. Edge protection complying with Section 1012.10.1 or 1012.10.2 shall be provided on each side of *ramp* runs and at each side of *ramp* landings.

Exceptions:

1. Edge protection is not required on *ramps* that are not required to have *handrails*, provided they have flared sides that comply with the *ICC A117.1* curb *ramp* provisions.
2. Edge protection is not required on the sides of *ramp* landings serving an adjoining *ramp* run or *stairway*.
3. Edge protection is not required on the sides of *ramp* landings having a vertical dropoff of not more than 1/2 inch (12.7 mm) within 10 inches (254 mm) horizontally of the required landing area.

1012.10.1 Curb, rail, wall or barrier. A curb, rail, wall or barrier shall be provided to serve as edge protection. A curb shall be not less than 4 inches (102 mm) in height. Barriers shall be constructed so that the barrier prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.

1012.10.2 Extended floor or ground surface. The floor or ground surface of the *ramp* run or landing shall extend 12 inches (305 mm) minimum beyond the inside face of a *handrail* complying with Section 1014.

SECTION 1013
EXIT SIGNS

[S] 1013.1 Where required. Exits and *exit access* doors shall be marked by an *approved* exit sign readily visible from any direction of egress travel. The path of egress travel to *exits* and within *exits* shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within *exits* shall be marked by exit signs. Exit sign placement shall be such that any point in an *exit access corridor* or *exit passageway* is within 100 feet (30 480 mm) or the *listed* viewing distance of the sign, whichever is less, from the nearest visible *exit* sign. Exit signs shall be located at any other location determined by the *building official* to be necessary to clearly indicate the direction of egress.

Exceptions:

1. Exit signs are not required in rooms or areas that require only one exit or *exit access* other than in buildings designed with a single exit stairway according to Section 1006.3.3 item 7.
2. Main exterior exit doors or gates that are obviously and clearly identifiable as *exits* need not have exit signs where *approved* by the building official.
3. Exit signs are not required in occupancies in Group U and individual *sleeping units* or *dwelling units* in Group R-1, R-2 or R-3.
4. Exit signs are not required in dayrooms, sleeping rooms or *dormitories* in occupancies in Group I-3.
5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.
6. Exit signs are not required on exterior stairways serving exterior exit balconies.

1013.2 Low-level exit signs in Group R-1. Where exit signs are required in Group R-1 occupancies by Section 1013.1, additional low-level exit signs shall be provided in all areas serving guest rooms in Group R-1 occupancies and shall comply with Section 1013.5.

The bottom of the sign shall be not less than 10 inches (254 mm) nor more than 18 inches (455 mm) above the floor level. The sign shall be flush mounted to the door or wall. Where mounted on the wall, the edge of the sign shall be within 4 inches (102 mm) of the door frame on the latch side.

1013.3 Illumination. Exit signs shall be internally or externally illuminated.

Exception: Tactile signs required by Section 1013.4 need not be provided with illumination.

1013.4 Raised character and braille exit signs. Where exit signs are provided at an *area of refuge* with *direct access* to a *stairway*, an exterior area for assisted rescue, an *exit stairway* or *ramp*, an *exit passageway, a horizontal exit* and the *exit discharge*, a sign stating accessways in visual characters, raised characters and braille and complying with ICC A117.1 shall be provided.

1013.5 Internally illuminated exit signs. Electrically powered, *self-luminous* and *photoluminescent* exit signs shall be *listed* and labeled in accordance with UL 924 and shall be installed in accordance with the manufacturer's instructions and Chapter 27. Exit signs shall be illuminated at all times.

[S] 1013.6 Externally illuminated exit signs. Externally illuminated exit signs shall comply with Sections 1013.6.1 through 1013.6.3.

1013.6.1 Graphics. Every exit sign and directional exit sign shall have plainly legible letters not less than 6 inches (152 mm) high with the principal strokes of the letters not less than 3/4 inch (19.1 mm) wide. The word "EXIT" shall have letters having a width not less than 2 inches (51 mm) wide, except the letter "I," and the minimum spacing between letters shall be not less than 3/8 inch (9.5 mm). Signs larger than the minimum established in this section shall have letter widths, strokes and spacing in proportion to their height.

The word "EXIT" shall be in high contrast with the background and shall be clearly discernible when the means of exit sign illumination is or is not energized. If a chevron directional indicator is provided as part of the exit sign, the construction shall be such that the direction of the chevron directional indicator cannot be readily changed.

Exception: Existing exit signs with letters at least 5 inches (127 mm) in height are permitted to be reused.

1013.6.2 Exit sign illumination. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux).

1013.6.3 Power source. Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Chapter 27. Group I-2, Condition 2 exit sign illumination shall not be provided by unit equipment batteries only.

Exception: *Approved* exit sign illumination types that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.

[S] 1013.7 Not-an-exit warnings. Placards reading "NOT AN EXIT" shall be installed at all doorways, passageways or stairways that are not exits, exit accesses or exit discharges, and that may be mistaken for an exit. A sign indicating the use of the doorway, passageway or stairway, such as "TO BASEMENT," "STORE ROOM," "LINEN CLOSET," is permitted in lieu of the "NOT AN EXIT" sign.

SECTION 1014
HANDRAILS

1014.1 Where required. *Handrails* serving *flights of stairways*, *ramps*, stepped *aisles* and ramped *aisles* shall be adequate in strength and attachment in accordance with Section 1607.9. *Handrails* required for flights of *stairways* by Section 1011.11 shall comply with Sections 1014.2 through 1014.9. *Handrails* required for *ramps* by Section 1012.8 shall comply with Sections 1014.2 through 1014.8. *Handrails* for stepped *aisles* and ramped *aisles* required by Section 1030.16 shall comply with Sections 1014.2 through 1014.8.

[W] 1014.2 Height and location. Handrails serving flights of stairways, ramps, stepped aisles, and ramped aisles shall comply with the provisions of Sections 1014.2.1 and 1014.2.2.

1014.2.1 Height. *Handrail* height, measured above *stair* tread *nosings*, or finish surface of *ramp* slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm). *Handrail* height of *alternating tread devices* and ships ladders, measured above tread *nosings*, shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

Exceptions:

1. Where *handrail* fittings or bendings are used to provide continuous transition between flights, the fittings or bendings shall be permitted to exceed the maximum height.
2. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are associated with a Group R-3 occupancy or associated with individual *dwelling units* in Group R-2 occupancies; where *handrail* fittings or bendings are used to provide continuous transition between flights, transition at *winder* treads, transition from *handrail* to guard, or where used at the start of a *flight*, the *handrail* height at the fittings or bendings shall be permitted to exceed the maximum height.

3. *Handrails* on top of a *guard* where permitted along stepped *aisles* and ramped *aisles* in accordance with Section 1030.16.

1014.2.2 Lateral location. Handrails located outward from the edge of the walking surface of flights of stairways, ramps, stepped aisles, and ramped aisles shall be located within 6 inches (152.4 mm) measured horizontally from the edge of the walking surface. Handrails projecting into the width of the walking surface shall comply with Section 1014.8.

1014.3 Handrail graspability. Required *handrails* shall comply with Section 1014.3.1 or shall provide equivalent graspability.

Exception: In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual *dwelling units* in Group R-2 occupancies; *handrails* shall be Type I in accordance with Section 1014.3.1, Type II in accordance with Section 1014.3.2 or shall provide equivalent graspability.

1014.3.1 Type I. *Handrails* with a circular cross section shall have an outside diameter of not less than 1-1/4 inches (32 mm) and not greater than 2 inches (51 mm). Where the *handrail* is not circular, it shall have a perimeter dimension of not less than 4 inches (102 mm) and not greater than 6-1/4 inches (160 mm) with a maximum cross-sectional dimension of 2-1/4 inches (57 mm) and minimum cross-sectional dimension of 1 inch (25 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

1014.3.2 Type II. *Handrails* with a perimeter greater than 6-1/4 inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of 3/4 inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of not less than 5/16 inch (8 mm) within 7/8 inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than 3/8 inch (10 mm) to a level that is not less than 1-3/4 inches (45 mm) below the tallest portion of the profile. The width of the *handrail* above the recess shall be not less than 1-1/4 inches (32 mm) to not greater than 2-3/4 inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

1014.4 Continuity. *Handrail* gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

Exceptions:

1. *Handrails* within *dwelling units* are permitted to be interrupted by a newel post at a turn or landing.
2. Within a *dwelling unit*, the use of a volute, turnout, starting easing or starting newel is allowed over the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the *handrail* that do not project horizontally beyond the sides of the *handrail* within 1-1/2 inches (38 mm) of the bottom of the *handrail* shall not be considered obstructions. For each 1/2 inch (12.7 mm) of additional *handrail* perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of 1-1/2 inches (38 mm) shall be permitted to be reduced by 1/8 inch (3.2 mm).
4. Where *handrails* are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of the *handrail* gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper *guards*.
5. *Handrails* serving stepped *aisles* or ramped *aisles* are permitted to be discontinuous in accordance with Section 1030.16.1.

1014.5 Fittings. *Handrails* shall not rotate within their fittings.

1014.6 Handrail extensions. *Handrails* shall return to a wall, *guard* or the walking surface or shall be continuous to the *handrail* of an adjacent *flight of stairs* or *ramp* run. Where *handrails* are not continuous between flights, the *handrails* shall extend horizontally not less than 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. At *ramps* where *handrails* are not continuous between runs, the *handrails* shall extend horizontally above the landing 12 inches (305 mm) minimum beyond the top and bottom of *ramp* runs. The extensions of *handrails* shall be in the same direction of the flights of *stairs* at *stairways* and the *ramp* runs at *ramps*.

Exceptions:

1. *Handrails* within a *dwelling unit* that is not required to be *accessible* need extend only from the top riser to the bottom riser.
2. *Handrails* serving *aisles* in rooms or spaces used for assembly purposes are permitted to comply with the *handrail* extensions in accordance with Section 1030.16.
3. *Handrails* for *alternating tread devices* and ships ladders are permitted to terminate at a location vertically above the top and bottom risers. *Handrails* for *alternating tread devices* are not required to be continuous between flights or to extend beyond the top or bottom risers.

1014.7 Clearance. Clear space between a *handrail* and a wall or other surface shall be not less than 1-1/2 inches (38 mm). A *handrail* and a wall or other surface adjacent to the *handrail* shall be free of any sharp or abrasive elements.

[W] 1014.8 Projections. On *ramps* and on ramped *aisles* that are part of an *accessible* route, the clear width between *handrails* shall be 36 inches (914 mm) minimum. Projections into the required width of stepped and ramped *aisles*, flights of *stairways* and *ramps* at each side shall not exceed 4-1/2 inches (114 mm) at or below the *handrail* height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1011.3. Projections due to intermediate *handrails* shall not constitute a reduction in the egress width. Where a pair of intermediate *handrails* are provided within the *stairway* width without a walking surface between the pair of intermediate *handrails* and the distance between the pair of intermediate *handrails* is greater than 6 inches (152 mm), the available egress width shall be reduced by the distance between the closest edges of each such intermediate pair of *handrails* that is greater than 6 inches (152 mm).

1014.9 Intermediate handrails. *Stairways* shall have intermediate *handrails* located in such a manner that all portions of the *stairway* minimum width or required capacity are within 30 inches (762 mm) of a *handrail*. On monumental *stairs*, *handrails* shall be located along the most direct path of egress travel.

SECTION 1015
GUARDS

1015.1 General. *Guards* shall comply with the provisions of Sections 1015.2 through 1015.7. Operable windows with sills located more than 72 inches (1829 mm) above finished grade or other surface below shall comply with Section 1015.8.

[W] 1015.2 Where required. *Guards* shall be located along open-sided walking surfaces, including *mezzanines*, equipment platforms, *lofts* in accordance with Section 420.14, *aisles*, *stairs*, *ramps* and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. *Guards* shall be provided at the perimeter of the occupied portions of an *occupied roof*. *Guards* shall be adequate in strength and attachment in accordance with Section 1607.9.

Exceptions: *Guards* are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of *stages* and raised *platforms*, including *stairs* leading up to the *stage* and raised *platforms*.
3. On raised *stage* and *platform* floor areas, such as runways, *ramps* and side *stages* used for entertainment or presentations.
4. At vertical openings in the performance area of *stages* and *platforms*.
5. At elevated walking surfaces appurtenant to *stages* and *platforms* for access to and utilization of special lighting or equipment.
6. Along vehicle service pits not accessible to the public.
7. In assembly seating areas at cross *aisles* in accordance with Section 1030.17.2.
8. On the loading side of station platforms on fixed guideway transit or passenger rail systems.
9. Portions of an *occupied roof* located less than 30 inches measured vertically to adjacent unoccupied roof areas when *approved guards* are present at the perimeter of the roof.
10. At an occupied portion of an *occupied roof* where a barrier *approved* by the *building official* is provided.

1015.2.1 Glazing. Where glass is used to provide a *guard* or as a portion of the *guard* system, the *guard* shall comply with Section 2407. Where the glazing provided does not meet the strength and attachment requirements of Section 1607.9, complying *guards* shall be located along glazed sides of open-sided walking surfaces.

[W] 1015.3 Height. Required *guards* shall be not less than 42 inches (1067 mm) high, measured vertically as follows:

1. From the adjacent walking surfaces.
2. On *stairways* and stepped *aisles*, from the line connecting the leading edges of the tread *nosings*.
3. On *ramps* and ramped *aisles*, from the *ramp* surface at the guard.

Exceptions:

1. For occupancies in Group R-3 not more than three stories above grade in height and within individual *dwelling units* in occupancies in Group R-2 not more than three stories above grade in height with separate *means of egress*, required *guards* shall be not less than 36 inches (914 mm) in height measured vertically above the adjacent walking surfaces.
2. For occupancies in Group R-3, and within individual *dwelling units* in occupancies in Group R-2, *guards* on the open sides of *stairs* shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
3. For occupancies in Group R-3, and within individual *dwelling units* in occupancies in Group R-2, where the top of the *guard* serves as a *handrail* on the open sides of *stairs*, the top of the *guard* shall be not less than 34 inches (864

mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

4. In areas with ceiling heights of 7 feet (2134 mm) or less in *lofts* constructed in accordance with Section 420.14, *guards* shall not be less than 36 inches (914 mm) in height or one-half of the clear height from the *loft* floor to the *loft* ceiling, whichever is less.

((4)) 5. The *guard* height in assembly seating areas shall comply with Section 1030.17 as applicable.

((5)) 6. Along *alternating tread devices* and ships ladders, *guards* where the top rail serves as a *handrail* shall have height not less than 30 inches (762 mm) and not more than 34 inches (864 mm), measured vertically from the leading edge of the device tread *nosing*.

((6)) 7. In Group F occupancies where *exit access stairways* serve fewer than three stories and such *stairways* are not open to the public, and where the top of the *guard* also serves as a *handrail*, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

1015.4 Opening limitations. Required *guards* shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter from the walking surface to the required *guard* height.

Exceptions:

1. From a height of 36 inches (914 mm) to 42 inches (1067 mm), *guards* shall not have openings that allow passage of a sphere 4-3/8 inches (111 mm) in diameter.
2. The triangular openings at the open sides of a *stair*, formed by the riser, tread and bottom rail shall not allow passage of a sphere 6 inches (152 mm) in diameter.
3. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or equipment, *guards* shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.
4. In areas that are not open to the public within occupancies in Group I-3, F, H or S, and for *alternating tread devices* and ships ladders, *guards* shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.
5. In assembly seating areas, *guards* required at the end of *aisles* in accordance with Section 1030.17.4 shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, *guards* shall not have openings that allow passage of a sphere 8 inches (203 mm) in diameter.
6. Within individual *dwelling units* and *sleeping units* in Group R-2 and R-3 occupancies, *guards* on the open sides of *stairs* shall not have openings that allow passage of a sphere 4-3/8 (111 mm) inches in diameter.

1015.5 Screen porches. Porches and decks that are enclosed with insect screening shall be provided with *guards* where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

[S] 1015.6 ((~~Mechanical equipment~~)) Equipment, systems and devices. *Guards* shall be provided where various components that require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The *guard* shall extend not less than 30 inches (762 mm) beyond each end of such components. The *guard* shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: *Guards* are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

[S] 1015.7 Roof access. *Guards* shall be provided where the roof hatch opening is located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The *guard* shall extend not less than 30 inches (762 mm) beyond each end of the hatch parallel to the roof edge. The *guard* shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

((~~**Exception:** *Guards* are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.~~))

1015.8 Window openings. Windows in Group R-2 and R-3 buildings including *dwelling units*, where the bottom of the clear opening of an operable window is located less than 36 inches (914 mm) above the finished floor and more than 72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, shall comply with one of the following:

1. Operable windows where the top of the sill of the opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below and that are provided with window fall prevention devices that comply with ASTM F2006.
2. Operable windows where the openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the window is in its largest opened position.

3. Operable windows where the openings are provided with window fall prevention devices that comply with ASTM F2090.
4. Operable windows that are provided with window opening control devices that comply with Section 1015.8.1.

1015.8.1 Window opening control devices. Window opening control devices shall comply with ASTM F2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1031.3.1.

SECTION 1016
EXIT ACCESS

1016.1 General. The *exit access* shall comply with the applicable provisions of Sections 1003 through 1015. *Exit access* arrangement shall comply with Sections 1016 through 1021.

[S] 1016.2 Egress through intervening spaces. Egress through intervening spaces shall comply with this section.

1. *Exit access* through an enclosed elevator lobby is permitted. Where access to two or more exits or exit access doorways is required in Section 1006.2.1, access to not less than one of the required *exits* shall be provided without travel through the enclosed elevator lobbies required by Section ((~~3006~~)) 713.14. Where the path of *exit access* travel passes through an enclosed elevator lobby, the level of protection required for the enclosed elevator lobby is not required to be extended to the *exit* unless direct access to an *exit* is required by other sections of this code.
2. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas and the area served are accessory to one or the other, are not a Group H occupancy and provide a discernible path of egress travel to an exit.

   Exception: *Means of egress* are not prohibited through adjoining or intervening rooms or spaces in a Group H, S or F occupancy where the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.
3. An *exit access* shall not pass through a room that can be locked to prevent egress.
4. *Means of egress* from *dwelling units* or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.
5. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes.

   Exceptions:

   1. *Means of egress* are not prohibited through a kitchen area serving adjoining rooms constituting part of the same *dwelling unit* or *sleeping unit*.
   2. *Means of egress* are not prohibited through stockrooms in Group M occupancies where all of the following are met:
      2.1. The stock is of the same hazard classification as that found in the main retail area.
      2.2. Not more than 50 percent of the *exit access* is through the stockroom.
      2.3. The stockroom is not subject to locking from the egress side.
      2.4. There is a demarcated, minimum 44-inch-wide (1118 mm) *aisle* defined by full- or partial-height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.
6. Unless *approved* by the *building official*, where two or more exits are required, exit travel shall not pass through an interior exit stairway as the only way to reach another exit.

Note: See Section 1010.2.4 for conditions in which exit access doors from elevator lobbies are permitted to be locked.

1016.2.1 Multiple tenants. Where more than one tenant occupies any one floor of a building or structure, each tenant space, *dwelling unit* and *sleeping unit* shall be provided with access to the required *exits* without passing through adjacent tenant spaces, *dwelling units* and *sleeping units*.

Exception: The *means of egress* from a smaller tenant space shall not be prohibited from passing through a larger adjoining tenant space where such rooms or spaces of the smaller tenant occupy less than 10 percent of the area of the larger tenant space through which they pass; are the same or similar occupancy group; a discernible path of egress travel to an *exit* is provided; and the *means of egress* into the adjoining space is not subject to locking from the egress side. A required *means of egress* serving the larger tenant space shall not pass through the smaller tenant space or spaces.

SECTION 1017
EXIT ACCESS TRAVEL DISTANCE

1017.1 General. Travel distance within the *exit access* portion of the *means of egress* system shall be in accordance with this section.

Note: Additional interior exit stairways or corridors constructed as smoke barriers may be required for standpipe hose connections. See Section 905.4.

1017.2 Limitations. *Exit access* travel distance shall not exceed the values given in Table 1017.2.

[W][S] TABLE 1017.2
EXIT ACCESS TRAVEL DISTANCE[a]

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200[e]	250[b]
I-1	Not Permitted	250[b]
B	200	300[c]
F-2, S-2, U	300	400[c]
H-1	Not Permitted	75[d]
H-2	Not Permitted	100[d]
H-3	Not Permitted	150[d]
H-4	Not Permitted	175[d]
H-5	Not Permitted	200[c]
I-2, I-3	Not Permitted	200[c]
I-4	150	200[c]

For SI: 1 foot = 304.8 mm.

a. See the following sections for modifications to *exit access* travel distance requirements:
Section 402.8: For the distance limitation in malls.
Section 407.4: For the distance limitation in Group I-2.
Sections 408.6.1 and 408.8.1: For the distance limitations in Group I-3.
Section 411.2: For the distance limitation in special amusement areas.
Section 412.6: For the distance limitations in aircraft manufacturing facilities.
Section 1006.2.2.2: For the distance limitation in refrigeration machinery rooms.
Section 1006.2.2.3: For the distance limitation in refrigerated rooms and spaces.
Section 1006.3.4: For buildings with one exit.
Section 1017.2.2: For increased distance limitation in Groups F-1 and S-1.
Section 1030.7: For increased limitation in assembly seating.
((~~Section 3103.4: For temporary structures.~~))
Section 3104.9: For pedestrian walkways.
Section 3116: For fixed guideway and passenger rail stations.

b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

d. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.1.

e. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.

1017.2.1 Exterior egress balcony increase. *Exit access* travel distances specified in Table 1017.2 shall be increased up to an additional 100 feet (30 480 mm) provided that the last portion of the *exit access* leading to the exit occurs on an exterior egress balcony constructed in accordance with Section 1021. The length of such balcony shall be not less than the amount of the increase taken.

1017.2.2 Groups F-1 and S-1 increase. The maximum *exit access* travel distance shall be 400 feet (122 m) in Group F-1 or S-1 occupancies where all of the following conditions are met:

1. The portion of the building classified as Group F-1 or S-1 is limited to one *story* in height.
2. The minimum height from the finished floor to the bottom of the ceiling or roof slab or deck is 24 feet (7315 mm).
3. The building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

SECTION 1019
EXIT ACCESS STAIRWAYS AND RAMPS

1019.1 General. *Exit access stairways* and *ramps* serving as an *exit access* component in a *means of egress* system shall comply with the requirements of this section. The number of stories connected by *exit access stairways* and *ramps* shall include *basements*, but not *mezzanines*.

1019.2 All occupancies. *Exit access stairways* and *ramps* that serve floor levels within a single *story* are not required to be enclosed.

[W][S] 1019.3 Occupancies other than Groups I-2 and I-3. In other than Group I-2 and I-3 occupancies, floor openings containing *exit access stairways* or *ramps* shall be enclosed with a shaft enclosure constructed in accordance with Section 713.

Exceptions:

1. *Exit access stairways* and *ramps* that serve or atmospherically communicate between only two adjacent stories. Such interconnected stories shall not be open to other stories.
2. In Group R-1, R-2 or R-3 occupancies, *exit access stairways* and *ramps* connecting four stories or less serving and contained within an individual dwelling unit or sleeping unit or live/work unit.
3. *Exit access stairways* serving and contained within a Group R-3 congregate residence or a Group R-4 facility are not required to be enclosed.
4. *Exit access stairways* and *ramps* that are designed exclusively for circulation in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or *ramp* and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.
5. *Exit access stairways* and *ramps* within an *atrium* complying with the provisions of Section 404.
6. *Exit access stairways* and *ramps* in *open parking garages* that serve only the parking garage.
7. *Exit access stairways* and *ramps* serving smoke-protected or *open-air assembly seating* complying with the exit access travel distance requirements of Section 1030.7.
8. *Exit access stairways* and *ramps* between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, *places of religious worship*, auditoriums and sports facilities.
9. Exterior *exit access stairways* or *ramps* between occupied roofs.

1019.4 Group I-2 and I-3 occupancies. In Group I-2 and I-3 occupancies, floor openings between stories containing *exit access stairways* or *ramps* are required to be enclosed with a shaft enclosure constructed in accordance with Section 713.

Exception: In Group I-3 occupancies, *exit access stairways* or *ramps* constructed in accordance with Section 408 are not required to be enclosed.

SECTION 1020
CORRIDORS

1020.1 General. Corridors serving as an exit access component in a *means of egress* system shall comply with the requirements of Sections 1020.2 through 1020.7.

[S] 1020.2 Construction. Corridors shall be fire-resistance rated in accordance with Table 1020.2. The *corridor* walls required to be fire-resistance rated shall comply with Section 708 for *fire partitions*.

Exceptions:

1. A *fire-resistance rating* is not required for *corridors* in an occupancy in Group E where each room that is used for instruction has not less than one door opening directly to the exterior and rooms for assembly purposes have not less than one-half of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A *fire-resistance rating* is not required for *corridors* contained within a *dwelling unit* or *sleeping unit* in an occupancy in Groups I-1 and R.
3. A *fire-resistance rating* is not required for *corridors* in *open parking garages*.
4. A *fire-resistance rating* is not required for *corridors* in an occupancy in Group B that is a space requiring only a single *means of egress* complying with Section 1006.2.
5. *Corridors* adjacent to the *exterior walls* of buildings shall be permitted to have unprotected openings on unrated *exterior walls* where unrated walls are permitted by Table 705.5 and unprotected openings are permitted by Table 705.8.

6. In office areas located in buildings of Types IA or IB construction, corridor walls need not be of fire-resistance-rated construction where the corridor side of the corridor walls is finished with materials having a maximum Class B rating as defined in Chapter 8. This exception does not apply to outpatient clinics and medical offices.
7. The occupant load of Group B conference rooms, lunch rooms without grease-producing cooking and other assembly rooms with an occupant load of less than 50 in each room need not be considered when determining whether corridor construction is required, provided such rooms are accessory to an office tenant located in a building of Type IA or IB construction. This provision is permitted to be used in other construction types when the floor on which the assembly room is located is equipped with an *automatic sprinkler system*.

[S] 1020.2.1 Hoistway opening protection. Elevator hoistway openings shall be protected in accordance with Section ((~~3006.2.1~~)) 713.14.2.1.

[S] TABLE 1020.2
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system
H-1, H-2, H-3	All	Not Permitted	1[c]
H-4, H-5	Greater than 30	Not Permitted	1[c]
A, B, E, F, M, S, U	Greater than 30	1	0
R	((~~Greater than 10~~)) All	Not Permitted	((~~0.5[e]~~)) 1[d]
I-2[a]	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b, c]
I-4	All	1	0

a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3.
b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.8.
c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
d. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.

1020.3 Width and capacity. The required capacity of *corridors* shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.3.

Exception: In Group I-2 occupancies, *corridors* are not required to have a clear width of 96 inches (2438 mm) in areas where there will not be stretcher or bed movement for access to care or as part of the *defend-in-place* strategy.

TABLE 1020.3
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed in this table	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a dwelling unit	36
In Group E with a corridor having an occupant load of 100 or more	72
In corridors and areas serving stretcher traffic in ambulatory care facilities	72
Group I-2 in areas where required for bed movement	96

For SI: 1 inch = 25.4 mm.

1020.4 Obstruction. The minimum width or required capacity of *corridors* shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

[S] 1020.5 Dead ends. Where more than one *exit* or *exit access doorway* is required, the *exit access* shall be arranged such that dead-end *corridors* do not exceed ((~~20 feet (6096 mm)~~)) 25 feet (7620 mm) in length.

Exceptions:

1. In Group I-3, Condition 2, 3 or 4, occupancies, the dead end in a *corridor* shall not exceed 50 feet (15 240 mm).
2. In occupancies in Groups B, E, F, I-1, M, R-1, R-2, S and U, where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, the length of the dead-end *corridors* shall not exceed 50 feet (15 240 mm).

3. A dead-end *corridor* shall not be limited in length where the length of the dead-end *corridor* is less than 2.5 times the least width of the dead-end *corridor*.
4. In Group I-2, Condition 2 occupancies, the length of dead-end *corridors* that do not serve patient rooms or patient treatment spaces shall not exceed 30 feet (9144 mm).
5. Dead ends are permitted to be 75 feet (22 860 mm) in length in areas containing Group B offices in buildings of Types IA and IB construction, where the cumulative occupant load does not exceed 50 for all areas for which the dead end serves as the only means of egress.

[S] 1020.6 Air movement in corridors. *Corridors* shall not serve as supply, return, exhaust, relief or ventilation air ducts or plenums except as allowed by Mechanical Code Section 601.2.

~~((**Exceptions:**~~

~~1. Use of a *corridor* as a source of makeup air for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such *corridor* is directly supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.~~

~~2. Where located within a *dwelling unit*, the use of *corridors* for conveying return air shall not be prohibited.~~

~~3. Where located within tenant spaces of 1,000 square feet (93 m^2) or less in area, utilization of *corridors* for conveying return air is permitted.~~

~~4. Transfer air movement required to maintain the pressurization difference within health care facilities in accordance with ASHRAE 170.~~))

1020.6.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The *corridor* is not required to be of *fire-resistance-rated* construction.
2. The *corridor* is separated from the plenum by *fire-resistance-rated* construction.
3. The air-handling system serving the *corridor* is shut down upon activation of the air-handling unit smoke detectors required by the *International Mechanical Code*.
4. The air-handling system serving the *corridor* is shut down upon detection of sprinkler water flow where the building is equipped throughout with an automatic sprinkler system.
5. The space between the corridor ceiling and the floor or roof structure above the *corridor* is used as a component of an *approved* engineered smoke control system.

1020.7 Corridor continuity. *Fire-resistance-rated corridors* shall be continuous from the point of entry to an *exit*, and shall not be interrupted by intervening rooms. Where the path of egress travel within a *fire-resistance-rated corridor* to the *exit* includes travel along unenclosed *exit access stairways* or *ramps*, the *fire-resistance rating* shall be continuous for the length of the *stairway* or *ramp* and for the length of the connecting *corridor* on the adjacent floor leading to the exit.

Exceptions:

1. Foyers, lobbies or reception rooms constructed as required for *corridors* shall not be construed as intervening rooms.
2. Enclosed elevator lobbies as permitted by Item 1 of Section 1016.2 shall not be construed as intervening rooms.

SECTION 1021
EGRESS BALCONIES

1021.1 General. Balconies used for egress purposes shall conform to the same requirements as *corridors* for minimum width, required capacity, headroom, dead ends and projections.

[S] 1021.2 Wall separation. Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for *corridors*.

Exceptions:

1. Separation is not required where the exterior egress balcony is served by not less than two *stairways* and a dead-end travel condition does not require travel past an unprotected opening to reach a *stairway*.
2. Separation is not required in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.

1021.3 Openness. The long side of an egress balcony shall be not less than 50 percent open, and the open area above the *guards* shall be so distributed as to minimize the accumulation of smoke or toxic gases.

1021.4 Location. Exterior egress balconies shall have a minimum *fire separation distance* of 10 feet (3048 mm) measured at right angles from the exterior edge of the egress balcony to the following:

1. Adjacent *lot lines*.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building *exterior walls* and openings are protected in accordance with Section 705 based on *fire separation distance*.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

SECTION 1022
EXITS

1022.1 General. *Exits* shall comply with Sections 1022 through 1027 and the applicable requirements of Sections 1003 through 1015. An *exit* shall not be used for any purpose that interferes with its function as a *means of egress*. Once a given level of *exit* protection is achieved, such level of protection shall not be reduced until arrival at the *exit discharge*. Exits shall be continuous from the point of entry into the *exit* to the *exit discharge*.

1022.2 Exterior exit doors. Buildings or structures used for human occupancy shall have not less than one exterior door that meets the requirements of Section 1010.1.1.

1022.2.1 Detailed requirements. Exterior *exit* doors shall comply with the applicable requirements of Section 1010.1.

1022.2.2 Arrangement. Exterior *exit* doors shall lead directly to the *exit discharge* or the *public way*.

SECTION 1023
INTERIOR EXIT STAIRWAYS AND RAMPS

1023.1 General. *Interior exit stairways* and *ramps* serving as an exit component in a *means of egress* system shall comply with the requirements of this section. *Interior exit stairways* and *ramps* shall be enclosed and lead directly to the exterior of the building or shall be extended to the exterior of the building with an *exit passageway* conforming to the requirements of Section 1024, except as permitted in Section 1028.2. An *interior exit stairway* or *ramp* shall not be used for any purpose other than as a *means of egress* and a *circulation path*.

[S] 1023.2 Construction. Enclosures for interior exit *stairways* and *ramps* shall be constructed as *fire barriers* in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. *Interior exit stairway* and *ramp* enclosures shall have a *fire-resistance rating* of not less than 2 hours where connecting more than four stories ((~~or more~~)) and not less than 1 hour where connecting ((~~less than~~)) four stories or less. The number of stories connected by the interior exit *stairways* or *ramps* shall include any *basements*, but not any *mezzanines*. Enclosures for interior *exit stairways* and *ramps* shall have a *fire-resistance rating* not less than the floor assembly penetrated, but need not exceed 2 hours.

Exceptions:

1. *Interior exit stairways* and *ramps* in Group I-3 occupancies in accordance with the provisions of Section 408.3.8.
2. *Interior exit stairways* within an *atrium* enclosed in accordance with Section 404.6.
3. Interior exit stairways in accordance with Section 510.2.

1023.3 Termination. *Interior exit stairways* and *ramps* shall terminate at an *exit discharge* or a *public way*.

Exception: A combination of *interior exit stairways*, *interior exit ramps* and *exit passageways*, constructed in accordance with Sections 1023.2, 1023.3.1 and 1024, respectively, and forming a continuous protected enclosure, shall be permitted to extend an *interior exit stairway* or *ramp* to the *exit discharge* or a *public way*.

[S] 1023.3.1 Extension. Where *interior exit stairways* and *ramps* are extended to an *exit discharge* or a *public way* by an *exit passageway*, the *interior exit stairway* and *ramp* shall be separated from the *exit passageway* by a *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both. The *fire-resistance rating* shall be not less than that required for the *interior exit stairway* and *ramp*. A *fire door assembly* complying with Section 716 shall be installed in the *fire barrier* to provide a *means of egress* from the *interior exit stairway* and *ramp* to the *exit passageway*. Openings in the *fire barrier* other than the *fire door assembly* are prohibited. Penetrations of the *fire barrier* are prohibited.

Exceptions:

1. Penetrations of the *fire barrier* in accordance with Section 1023.5 shall be permitted.
2. Separation between an *interior exit stairway* or *ramp* and the *exit passageway* extension shall not be required where there are no openings into the *exit passageway* extension.

3. Separation between an *interior exit stairway* or *ramp* and the *exit passageway* extension shall not be required where the *interior exit stairway* and the *exit passageway* extension are pressurized in accordance with Section 909.20.5.

1023.4 Openings. *Interior exit stairway* and *ramp* opening protectives shall be in accordance with the requirements of Section 716.

Openings in *interior exit stairways* and *ramps* other than unprotected exterior openings shall be limited to those required for *exit access* to the enclosure from normally occupied spaces and for egress from the enclosure.

Elevators shall not open into *interior exit stairways* and *ramps*.

Interpretation I1023.4: Accessory rooms such as restrooms, storage closets, laundry rooms, electrical, communication closets, mechanical rooms and similar spaces shall not open directly into an interior exit stairway. Rooms and spaces that are separated from the stairway by a *corridor* or a vestibule are not considered to open directly into the interior exit stairway. The *corridor* or vestibule shall be constructed as a minimum 1-hour fire-resistance rated fire partition complying with Section 708. Openings shall comply with Sections 716.2.2.1 and 716.3.2.1.

[S] 1023.5 Penetrations. Penetrations into or through interior exit *stairways* and *ramps* are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. *Fire protection systems*.
3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication systems and sprinkler monitoring terminating at a steel box not exceeding 16 square inches (0.010 m^2).
6. Electrical raceway serving the *interior exit stairway* and *ramp* and terminating at a steel box not exceeding 16 square inches (0.010 m^2).
7. Structural elements supporting the *interior exit stairway* or *ramp* or enclosure, such as beams or joists.
8. Piping used exclusively for the drainage of rainfall runoff from roof areas, provided the roof is not used for a helistop or heliport.
9. Unfired unit heaters required for freeze protection of fire protection equipment are permitted to penetrate one membrane; the conduit serving the heater is permitted to penetrate both membranes.
10. Equipment necessary for electrically controlled stairway door locks and security cameras are permitted to penetrate one membrane; the conduit serving the equipment is permitted to penetrate both membranes.

Such penetrations shall be protected in accordance with Section 714. There shall not be penetrations or communication openings, whether protected or not, between adjacent interior exit *stairways* and *ramps*.

Interpretation I1023.5: Ducts passing through interior exit stairways shall be separated from the stairway by construction having a fire-resistance rating at least equal to the stairway walls. At least one side of the duct enclosure shall abut the interior exit stairway enclosure.

Exception: *Membrane penetrations* shall be permitted on the outside of the *interior exit stairway* and *ramp*. Such penetrations shall be protected in accordance with Section 714.4.2.

1023.6 Ventilation. Equipment and ductwork for *interior exit stairway* and *ramp* ventilation as permitted by Section 1023.5 shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the *interior exit stairway* and *ramp* by ductwork enclosed in construction as required for *shafts*.
2. Where such equipment and ductwork is located within the *interior exit stairway* and *ramp*, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for *shafts*.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for *shafts*.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 for shaft enclosures.

The *interior exit stairway* and *ramp* ventilation systems shall be independent of other building ventilation systems.

1023.7 Interior exit stairway and ramp exterior walls. *Exterior walls* of the *interior exit stairway* or *ramp* shall comply with the requirements of Section 705 for *exterior walls*. Where nonrated walls or unprotected openings enclose the exterior of the *stairway* or *ramps* and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building *exterior walls* within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a *fire-resistance rating* of not less than 1 hour. Openings within such *exterior* walls shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost landing of the *stairway* or *ramp*, or to the roof line, whichever is lower.

1023.8 Barrier at level of exit discharge. An *interior exit stairway* and *ramp* shall not continue below its *level of exit discharge* unless an *approved* barrier is provided at the *level of exit discharge* to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in Section 1013.

[S] 1023.9 Stairway identification signs. A sign shall be provided at each floor landing in an *interior exit stairway* and *ramp* connecting more than three stories designating the floor level, the terminus of the top and bottom of the *interior exit stairway* and *ramp* and the identification of the *stairway* or *ramp*. The signage shall state the story of and direction to the *exit discharge*, and ((~~the availability of~~)) whether there is roof access from the *interior exit stairway* and *ramp* for the fire department, and whether the roof access is accessed by roof hatch. The bottom of the sign shall be located not less than 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

1023.9.1 Signage requirements. *Stairway* identification signs shall comply with all of the following requirements:

1. The signs shall be a minimum size of 18 inches (457 mm) by 12 inches (305 mm).
2. The letters designating the identification of the *interior exit stairway* and *ramp* shall be not less than 1-1/2 inches (38 mm) in height.
3. The number designating the floor level shall be not less than 5 inches (127 mm) in height and located in the center of the sign.
4. Other lettering and numbers shall be not less than 1 inch (25 mm) in height.
5. Characters and their background shall have a nonglare finish. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.
6. Where signs required by Section 1023.9 are installed in the interior exit *stairways* and *ramps* of buildings subject to Section 1025, the signs shall be made of the same materials as required by Section 1025.4.

1023.10 Elevator lobby identification signs. At landings in interior exit *stairways* where two or more doors lead to the floor level, any door with direct access to an enclosed elevator lobby shall be identified by signage located on the door or directly adjacent to the door stating "Elevator Lobby." Signage shall be in accordance with Section 1023.9.1, Items 4, 5 and 6.

1023.11 Tactile floor-level signs. Where floor level signs are provided in *interior exit stairways* and *ramps*, a floor-level sign identifying the floor level in visual characters, raised characters and braille complying with ICC A117.1 shall be located at each floor-level landing adjacent to the door leading from the *interior exit stairway* and *ramp* into the corridor.

[S] 1023.12 ((~~Smokeproof enclosures~~)) Pressurized stairways. Where required by Section 403.5.4, 405.7.2, ((~~or~~)) 412.2.2.1 or 510.2, interior exit *stairways* and *ramps* shall be ((~~*smokeproof enclosures*~~)) pressurized in accordance with Section 909.20.5 or 909.20.6.

1023.12.1 Termination and extension. A ((~~*smokeproof enclosure*~~)) pressurized stairway shall terminate at an *exit discharge* or a *public way*. The ((~~*smokeproof enclosure*~~)) pressurized stairway shall be permitted to be extended by an *exit passageway* in accordance with Section 1023.3. ((~~The *exit passageway* shall be without openings other than the *fire door assembly* required by Section 1023.3.1 and those necessary for egress from the *exit passageway*.~~)) The *exit passageway* shall be separated from the remainder of the building by 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *exit passageway* shall be protected and pressurized in the same manner as the pressurized stairway.

((~~Exceptions:~~

~~1. Openings in the *exit passageway* serving a *smokeproof enclosure* are permitted where the *exit passageway* is protected and pressurized in the same manner as the *smokeproof enclosure*, and openings are protected as required for access from other floors.~~

~~2. The *fire barrier* separating the *smokeproof enclosure* from the *exit passageway* is not required, provided that the *exit passageway* is protected and pressurized in the same manner as the *smokeproof enclosure*.~~

~~3.~~)) **Exception:** A ((~~*smokeproof enclosure*~~)) pressurized stairway shall be permitted to egress through areas on the *level of exit discharge* or vestibules as permitted by Section 1028.

((~~1023.12.2 Enclosure access.~~ ~~Access to the *stairway* or *ramp* within a *smokeproof enclosure* shall be by way of a vestibule or an open exterior balcony.~~

~~**Exception:** Access is not required by way of a vestibule or exterior balcony for *stairways* and *ramps* using the pressurization alternative complying with Section 909.20.5.~~))

1023.13 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

[S] 1023.14 Equipment in interior exit stairways. Equipment is prohibited in interior exit stairways except for equipment necessary for independent pressurization, lighting of the interior exit stairway, sprinkler piping, standpipes, electrical equipment for fire department communication and sprinkler monitoring, and unit heaters required to protect fire protection equipment from freezing.

SECTION 1024
EXIT PASSAGEWAYS

1024.1 General. Exit passageways serving as an exit component in a *means of egress* system shall comply with the requirements of this section. An *exit passageway* shall not be used for any purpose other than as a *means of egress* and a *circulation path*.

1024.2 Width and capacity. The required capacity of exit passageways shall be determined as specified in Section 1005.1 but the minimum width shall be not less than 44 inches (1118 mm), except that exit passageways serving an *occupant load* of less than 50 shall be not less than 36 inches (914 mm) in width. The minimum width or required capacity of exit passageways shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

1024.3 Construction. *Exit passageway* enclosures shall have walls, floors and ceilings of not less than a 1-hour *fire-resistance rating*, and not less than that required for any connecting *interior exit stairway* or *ramp*. Exit passageways shall be constructed as *fire barriers* in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

1024.4 Termination. Exit passageways on the *level of exit discharge* shall terminate at an *exit discharge*. Exit passageways on other levels shall terminate at an exit.

[S] 1024.5 Openings. *Exit passageway* opening protectives shall be in accordance with the requirements of Section 716.

((~~Except as permitted in Section 402.8.7, openings in exit passageways other than unprotected exterior openings shall be limited to those necessary for *exit access* to the *exit passageway* from normally occupied spaces and for egress from the *exit passageway*.~~))

The following openings are permitted in *exit passageways*:

1. Doors from rooms and spaces in accordance with Section 402.8.7;
2. Unprotected exterior openings;
3. Doors necessary for exit access from normally occupied spaces;
4. Doors necessary for egress from the *exit passageway*;
5. Doors from interior exit stairways.

Where an *interior exit stairway* or *ramp* is extended to an *exit discharge* or a *public way* by an *exit passageway*, the *exit passageway* shall comply with Section 1023.3.1.

Elevators shall not open into an *exit passageway*.

Interpretation I1024.5: Accessory rooms such as restrooms, storage closets, laundry rooms, electrical, communication closets, mechanical rooms and similar spaces shall not open directly into an *exit passageway*. Rooms and spaces that are separated from the *exit passageway* by a *corridor* or a vestibule are not considered to open directly into the *exit passageway*. The *corridor* or vestibule shall be constructed as a minimum 1-hour fire-resistance rated fire partition complying with Section 708. Openings shall comply with Sections 716.2.2.1 and 716.3.2.1.

Code Alternate CA1024.5: An elevator is permitted to open into an *exit passageway* when the following conditions are met:

1. A lobby shall separate the elevator from the *exit passageway*. This is allowed at only one location in the building. The lobby is required whether the elevator hoistway is pressurized or not.
2. The separation shall be constructed as a fire barrier having a fire-resistive rating and opening protectives as for the *exit passageway*. The door between the lobby and the *exit passageway* shall also comply with Section 716.2.2.1. The door shall have listed gaskets installed at head, jambs and meeting edges. This only applies to the walls common with the *exit passageway*.
3. The lobby shall have a minimum depth of 36 inches. (Note that areas of refuge may require a larger dimension).
4. An elevator lobby constructed as a smoke partition shall be provided at every floor below the level of the *exit passageway* served by the elevator. Hoistway pressurization is permitted to be used in lieu of the lobbies on floors below the level of the *exit passageway*.
5. A door as required by Section 1023.3.1 between an interior exit stairway and the *exit passageway* shall be provided.
6. An *automatic sprinkler system* in accordance with Section 903.3.1.1 shall be provided throughout the floor on which the *exit passageway* is located.

This alternate does not apply to interior exit stairways.

[S] 1024.6 Penetrations. Penetrations into or through an *exit passageway* are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. Fire protection systems.
3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication.
6. Electrical raceway serving the *exit passageway* and terminating at a steel box not exceeding 16 square inches (0.010 m^2).

Such penetrations shall be protected in accordance with Section 714. There shall not be penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

Exceptions:

1. *Membrane penetrations* shall be permitted on the outside of the *exit passageway*. Such penetrations shall be protected in accordance with Section 714.4.2.
2. Unfired unit heaters allowed by Section 1023.14 to be installed in interior exit stairways are permitted to penetrate one membrane. The conduit serving the heater is permitted to penetrate both membranes.

1024.7 Ventilation. Equipment and ductwork for *exit passageway* ventilation as permitted by Section 1024.6 shall comply with one of the following:

1. The equipment and ductwork shall be located exterior to the building and shall be directly connected to the *exit passageway* by ductwork enclosed in construction as required for *shafts*.
2. Where the equipment and ductwork is located within the *exit passageway*, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or the air shall be conveyed through ducts enclosed in construction as required for *shafts*.
3. Where located within the building, the equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for *shafts*.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 for shaft enclosures.

Exit passageway ventilation systems shall be independent of other building ventilation systems.

1024.8 Exit passageway exterior walls. *Exterior walls* of the *exit passageway* shall comply with Section 705. Where nonrated walls or unprotected openings enclose the exterior of the *exit passageway* and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building *exterior walls* within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a *fire-resistance rating* of not less than 1 hour. Openings within such *exterior walls* shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.

and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

Exception: The minimum width of 1 inch (25 mm) shall not apply to markings *listed* in accordance with UL 1994.

[S] 1025.2.6 Doors within the exit path. Doors through which occupants must pass in order to complete the exit path shall be provided with markings complying with Sections 1025.2.6.1 through 1025.2.6.3.

Exception: Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not be provided with markings where *approved* by the *building official*.

1025.2.6.1 Emergency exit symbol. The doors shall be identified by a low-location luminous emergency exit symbol complying with NFPA 170. The exit symbol shall be not less than 4 inches (102 mm) in height and shall be mounted on the door, centered horizontally, with the top of the symbol not higher than 18 inches (457 mm) above the finished floor.

1025.2.6.2 Door hardware markings. Door hardware shall be marked with not less than 16 square inches (10323 $mm^{2)}$ of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle or escutcheon. Where a *panic* bar is installed, such material shall be not less than 1 inch (25 mm) wide for the entire length of the actuating bar or touchpad.

1025.2.6.3 Door frame markings. The top and sides of the door frame shall be marked with a solid and continuous 1-inch- to 2-inch-wide (25 mm to 51 mm) stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

1025.3 Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same enclosure.

1025.4 Self-luminous and photoluminescent. Luminous egress path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not be limited to, *self-luminous* materials and *photoluminescent* materials. Materials shall comply with either of the following standards:

1. UL 1994.
2. ASTM E2072, except that the charging source shall be 1 footcandle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

1025.5 Illumination. Where *photoluminescent* exit path markings are installed, they shall be provided with not less than 1 footcandle (11 lux) of illumination for not less than 60 minutes prior to periods when the building is occupied and continuously during occupancy.

SECTION 1026
HORIZONTAL EXITS

1026.1 General. Horizontal *exits* serving as an *exit* in a *means of egress* system shall comply with the requirements of this section. A *horizontal exit* shall not serve as the only exit from a portion of a building, and where two or more *exits* are required, not more than one-half of the total number of *exits* or total exit minimum width or required capacity shall be horizontal *exits*.

Exceptions:

1. Horizontal *exits* are permitted to comprise two-thirds of the required *exits* from any building or floor area for occupancies in Group I-2.
2. Horizontal *exits* are permitted to comprise 100 percent of the *exits* required for occupancies in Group I-3. Not less than 6 square feet (0.6 m^2) of accessible space per occupant shall be provided on each side of the *horizontal exit* for the total number of people in adjoining compartments.

1026.2 Separation. The separation between buildings or refuge areas connected by a *horizontal exit* shall be provided by a *fire wall* complying with Section 706; or by a *fire barrier* complying with Section 707 or a *horizontal assembly* complying with Section 711, or both. The minimum *fire-resistance rating* of the separation shall be 2 hours. Opening protectives in horizontal *exits* shall also comply with Section 716. Duct and air transfer openings in a *fire wall* or *fire barrier* that serves as a *horizontal exit* shall also comply with Section 717. The *horizontal exit* separation shall extend vertically through all levels of the building unless floor assemblies have a *fire-resistance rating* of not less than 2 hours and do not have unprotected openings.

Exception: A *fire-resistance rating* is not required at horizontal *exits* between a building area and an above-grade *pedestrian walkway* constructed in accordance with Section 3104, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exits constructed as *fire barriers* shall be continuous from *exterior wall* to *exterior wall* so as to divide completely the floor served by the *horizontal exit*.

1026.3 Opening protectives. *Fire doors* in horizontal *exits* shall be *self-closing* or automatic-closing when activated by a smoke detector in accordance with Section 716.2.6.6. Doors, where located in a cross-*corridor* condition, shall be automatic-closing by activation of a smoke detector installed in accordance with Section 716.2.6.6.

1026.4 Refuge area. The refuge area of a *horizontal exit* shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original *occupant load* of the refuge area plus the *occupant load* anticipated from the adjoining compartment. The anticipated *occupant load* from the adjoining compartment shall be based on the capacity of the *horizontal exit doors* entering the refuge area or the total *occupant load* of the adjoining compartment, whichever is less.

1026.4.1 Capacity. The capacity of the refuge area shall be computed based on a *net floor area* allowance of 3 square feet (0.2787 m^2) for each occupant to be accommodated therein. Where the *horizontal exit* also forms a *smoke compartment*, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and Group B ambulatory care facilities shall comply with Sections 407.5.3, 408.6.2, 420.6.1 and 422.3.2 as applicable.

1026.4.2 Number of exits. The refuge area into which a *horizontal exit* leads shall be provided with *exits* adequate to meet the occupant requirements of this chapter, but not including the added *occupant load* imposed by persons entering the refuge area through horizontal *exits* from other areas. Not less than one refuge area exit shall lead directly to the exterior or to an *interior exit stairway* or ramp.

Exception: The adjoining compartment shall not be required to have a *stairway* or door leading directly outside, provided that the refuge area into which a *horizontal exit* leads has *stairways* or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

1026.5 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1027
EXTERIOR EXIT STAIRWAYS AND RAMPS

1027.1 General. Exterior exit stairways and ramps serving as an exit component in a *means of egress* system shall comply with the requirements of this section.

1027.2 Use in a means of egress. *Exterior exit stairways* shall not be used as an element of a required *means of egress* for Group I-2 occupancies. For occupancies in other than Group I-2, *exterior exit stairways* and *ramps* shall be permitted as an element of a required *means of egress* for buildings not exceeding six stories above grade plane or that are not *high-rise buildings*.

[S] 1027.3 Open side. *Exterior exit stairways* and *ramps* serving as an element of a required *means of egress* shall be at least 50 percent open on not less than one side. ((~~, except for required structural columns, beams, *handrails* and *guards*.~~)) An open side shall have not less than ((~~35 square feet (3.3 m^2)~~)) 28 square feet (2.6 m^2) of aggregate open area adjacent to each floor level. ((~~and the level of each intermediate landing. The required open area shall be located not less than 42 inches (1067 mm) above the adjacent floor or landing level.~~)) The open area shall be distributed to prevent accumulation of smoke or toxic gases.

1027.4 Side yards. The open areas adjoining *exterior exit stairways* or *ramps* shall be either *yards*, *courts* or *public ways*; the remaining sides are permitted to be enclosed by the *exterior walls* of the building.

1027.5 Location. *Exterior exit stairways* and *ramps* shall have a minimum *fire separation distance* of 10 feet (3048 mm) measured at right angles from the exterior edge of the *stairway* or *ramps*, including landings, to:

1. Adjacent *lot lines*.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building *exterior walls* and openings are protected in accordance with Section 705 based on *fire separation distance*.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

Exception: *Exterior exit stairways* and *ramps* serving individual *dwelling units* of Group R-3 shall have a minimum *fire separation distance* of 5 feet (1525 mm).

[S] 1027.6 Exterior exit stairway and ramp protection. *Exterior exit stairways* and *ramps* shall be separated from the interior of the building as required in Section 1023.2. Openings shall be limited to those necessary for egress from normally occupied spaces. Where a vertical plane projecting from the edge of an *exterior exit stairway* or *ramp* and landings is exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the *exterior wall* shall be rated in accordance with Section 1023.7.

Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are not more than two stories above grade plane where a *level of exit discharge* serving such occupancies is the first *story above grade plane*.
2. Separation from the interior of the building is not required where the *exterior exit stairway* or *ramp* is served by an *exterior exit ramp* or balcony that connects two remote exterior exit *stairways* or other *approved exits* with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be not less than 50 percent of the height of the enclosing wall, with the top of the openings not less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the open-ended *corridor* of the building is not required for *exterior exit stairways* or *ramps*, provided that Items 3.1 through 3.5 are met:
   3.1. The building, including open-ended *corridors*, and *stairways* and *ramps*, shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2.
   3.2. The open-ended *corridors* comply with Section 1020.
   3.3. The open-ended *corridors* are connected on each end to an *exterior exit stairway* or *ramp* complying with Section 1027.
   3.4. The *exterior walls* and openings adjacent to the *exterior exit stairway* or *ramp* comply with Section 1023.7 and 1027.7.
   3.5. At any location in an open-ended *corridor* where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m^2) or an *exterior stairway* or *ramp* shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.
4. In Group R-3 occupancies not more than four stories in height, *exterior exit stairways* and *ramps* serving individual *dwelling units* are not required to be separated from the interior of the building where the *exterior exit stairway* or *ramp* discharges directly to grade.

[S] 1027.7 Exterior exit stairway and ramp exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than 3/4 hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost landing of the stairway or to the roof line, whichever is lower.

SECTION 1028
EXIT DISCHARGE

1028.1 General. The exit discharge shall comply with Sections 1028 and 1029 and the applicable requirements of Sections 1003 through 1015.

[S] 1028.2 Exit discharge. *Exits* shall discharge directly to the exterior of the building. The *exit discharge* shall be at grade or shall provide a direct path of egress travel to grade. The *exit discharge* shall not reenter a building except into an exit or as otherwise *approved* by the *building official*. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and minimum width or required capacity of the required *exits*.

Exceptions:

1. Not more than 50 percent of the number and minimum width or required capacity of *interior exit stairways* and *ramps* is permitted to egress through areas, including *atriums*, on the level of discharge provided that all of the following conditions are met:
   1.1. Discharge of *interior exit stairways* and *ramps* shall be provided with a free and unobstructed path of travel to an exterior *exit* door and such *exit* is readily visible and identifiable from the point of termination of the enclosure.
   1.2. The entire area of the *level of exit discharge* is separated from areas below by construction conforming to the *fire-resistance rating* for the enclosure.
   1.3. The egress path from the *interior exit stairway* and *ramp* on the *level of exit discharge* is protected throughout by an *approved automatic sprinkler system*. Portions of the *level of exit discharge* with access to the egress path shall be either equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of *interior exit stairways* or *ramps*.

1.4. Where a required *interior exit stairway* or *ramp* and an *exit access stairway* or *ramp* serve the same floor level and terminate at the same *level of exit discharge*, the termination of the *exit access stairway* or *ramp* and the *exit discharge* door of the *interior exit stairway* or *ramp* shall be separated by a distance of not less than 30 feet (9144 mm) or not less than one-fourth the length of the maximum overall diagonal dimension of the building, whichever is less. The distance shall be measured in a straight line between the *exit discharge* door from the *interior exit stairway* or *ramp* and the last tread of the *exit access stairway* or termination of slope of the *exit access ramp*.

2. Not more than 50 percent of the number and minimum width or required capacity of the *interior exit stairways* and *ramps* is permitted to egress through a vestibule provided that all of the following conditions are met:

2.1. The entire area of the vestibule is separated from areas below by construction conforming to the *fire-resistance rating* of the *interior exit stairway* or *ramp enclosure*.

2.2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the ((~~length~~)) width is not greater than 30 feet (9144 mm).

2.3. The area is separated from the remainder of the *level of exit discharge* by a *fire partition* constructed in accordance with Section 708.

Exception: The maximum transmitted temperature rise is not required.

2.4. The area is used only for *means of egress* and *exits* directly to the outside.

Interpretation I1028.1: Exception 2 applies only to vestibules with *direct access* from the *interior exit stairway* or *ramp*.

3. *Horizontal exits* complying with Section 1026 shall not be required to discharge directly to the exterior of the building.

[S] 1028.2.1 Remoteness of egress paths at building exterior. The paths of egress travel from separate exits shall be separated by at least 10 feet at the exterior of the building. The separation shall be maintained for at least 10 feet, as measured from the face of the exterior wall containing the exits, before the paths of egress travel are permitted to converge. The paths of egress travel, before and after convergence, shall provide unobstructed access to a *public way*. Where 3 or more exits are required, at least 2 paths shall be arranged in accordance with this provision.

1028.3 Exit discharge width or capacity. The minimum width or required capacity of the *exit discharge* shall be not less than the minimum width or required capacity of the *exits* being served.

1028.4 Exit discharge components. *Exit discharge* components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases. *

[S] 1028.5 Access to a public way. The *exit discharge* shall provide a direct and unobstructed access to a *public way*. Converging paths of egress travel located in the *exit discharge* are permitted under the conditions of 1028.2.1.

Exception: Where access to a *public way* cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate not less than 5 square feet (0.46 m^2) for each person.
2. The area shall be located on the same lot not less than 50 feet (15 240 mm) away from the building requiring egress.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.

SECTION 1029
EGRESS COURTS **

1029.1 General. *Egress courts* serving as an *exit discharge* component in the *means of egress* system shall comply with the requirements in this section.

1029.2 Width or capacity. The required capacity of egress courts shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm), except as specified herein. Egress courts serving Group R-3 and U occupancies shall be not less than 36 inches (914 mm) in width. The required capacity and width of egress courts shall be unobstructed to a height of 7 feet (2134 mm). The width of the egress court shall be not less than the required capacity.

Exception: Encroachments complying with Section 1005.7.

[S] 1029.3 Construction and openings. Where an *egress court* serving a building or portion thereof is less than 10 feet (3048 mm) in width, the *egress court* walls shall have not less than 1-hour *fire-resistance-rated* construction for a distance of 10 feet (3048 mm) above the floor of the *egress court*. Openings within such walls shall be protected by opening protectives having a *fire protection rating* of not less than 3/4 hour.

Exceptions:

1. *Egress courts* serving an *occupant load* of less than 10.
2. *Egress courts* serving Group R-3.
3. In buildings other than those that have a single means of egress under Section 1006.3.4 item 7, opening protection need not be provided where it is possible to exit in two directions from the *court*.

SECTION 1030
ASSEMBLY

1030.1 General. A room or space used for assembly purposes that contains seats, tables, displays, equipment or other material shall comply with this section.

1030.1.1 Bleachers. *Bleachers*, *grandstands* and *folding and telescopic seating*, that are not building elements, shall comply with ICC 300.

1030.1.1.1 Spaces under grandstands and bleachers. Spaces under *grandstands* or *bleachers* shall be separated by *fire barriers* complying with Section 707 and *horizontal assemblies* complying with Section 711 with not less than 1-hour *fire-resistance-rated* construction.

Exceptions:

1. Ticket booths less than 100 square feet (9.29 m^2) in area.
2. Toilet rooms.
3. Other accessory use areas 1,000 square feet (92.9 m^2) or less in area and equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

1030.2 Assembly main exit. A building, room or space used for assembly purposes that has an *occupant load* of greater than 300 and is provided with a main *exit*, that main *exit* shall be of sufficient capacity to accommodate not less than one-half of the *occupant load*, but such capacity shall be not less than the total required capacity of all *means of egress* leading to the *exit*. Where the building is classified as a Group A occupancy, the main *exit* shall front on not less than one street or an unoccupied space of not less than 10 feet (3048 mm) in width that adjoins a street or *public way*. In a building, room or space used for assembly purposes where there is not a well-defined main *exit* or where multiple main *exits* are provided, *exits* shall be permitted to be distributed around the perimeter of the building provided that the total capacity of egress is not less than 100 percent of the required capacity.

1030.3 Assembly other exits. In addition to having access to a main *exit*, each level in a building used for assembly purposes having an *occupant load* greater than 300 and provided with a main *exit*, shall be provided with additional *means of egress* that shall provide an egress capacity for not less than one-half of the total *occupant load* served by that level and shall comply with Section 1007.1. In a building used for assembly purposes where there is not a well-defined main *exit* or where multiple main *exits* are provided, *exits* for each level shall be permitted to be distributed around the perimeter of the building, provided that the total width of egress is not less than 100 percent of the required width.

1030.4 Foyers and lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available, such persons shall be allowed to wait in a lobby or similar space, provided that such lobby or similar space shall not encroach on the minimum width or required capacity of the *means of egress*. Such foyer, if not directly connected to a public street by all the main entrances or *exits*, shall have a straight and unobstructed corridor or path of travel to every such main entrance or *exit*.

1030.5 Interior balcony and gallery means of egress. For balconies, galleries or press boxes having a seating capacity of 50 or more located in a building, room or space used for assembly purposes, not less than two *means of egress* shall be provided, with one from each side of every balcony, gallery or press box.

1030.6 Capacity of aisle for assembly. The required capacity of *aisles* shall be not less than that determined in accordance with Section 1030.6.1 where *smoke-protected assembly seating* is not provided, Section 1030.6.2 where *smoke-protected assembly seating* is provided and Section 1030.6.3 where *open-air assembly seating* is provided.

1030.6.1 Without smoke protection. The required capacity in inches (mm) of the *aisles* for assembly seating without smoke protection shall be not less than the *occupant load* served by the egress element in accordance with all of the following, as applicable:

1. Not less than 0.3 inch (7.6 mm) of aisle capacity for each occupant served shall be provided on stepped *aisles* having riser heights 7 inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread *nosings*.
2. Not less than 0.005 inch (0.127 mm) of additional aisle capacity for each occupant shall be provided for each 0.10 inch (2.5 mm) of riser height above 7 inches (178 mm).

1030.16.1 Discontinuous mid-aisle handrails. Where there is seating on both sides of the *aisle*, the mid-aisle *handrails* shall be discontinuous. Where a stepped *aisle* is required to have two *handrails*, the mid-aisle *handrails* shall be discontinuous. Gaps or breaks shall be provided at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the *aisle* to the other. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the mid-aisle *handrail* shall have rounded terminations or bends.

1030.16.2 Handrail termination. *Handrails* located on the side of stepped *aisles* shall return to a wall, *guard* or the walking surface or shall be continuous to the *handrail* of an adjacent stepped *aisle flight*.

1030.16.3 Mid-aisle termination. Mid-aisle *handrails* shall not extend beyond the lowest riser and shall terminate within 18 inches (381 mm), measured horizontally, from the lowest riser. *Handrail* extensions are not required.

Exception: Mid-aisle *handrails* shall be permitted to extend beyond the lowest riser where the *handrail* extensions do not obstruct the width of the cross *aisle*.

1030.16.4 Rails. Where mid-aisle *handrails* are provided in stepped *aisles*, there shall be an additional rail located approximately 12 inches (305 mm) below the *handrail*. The rail shall be adequate in strength and attachment in accordance with Section 1607.9.1.2.

1030.17 Assembly guards. *Guards* adjacent to seating in a building, room or space used for assembly purposes shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015 except where provided in accordance with Sections 1030.17.1 through 1030.17.4. At *bleachers*, *grandstands* and *folding and telescopic seating*, *guards* must be provided where required by ICC 300 and Section 1030.17.1.

1030.17.1 Perimeter guards. Perimeter *guards* shall be provided where the footboards or walking surface of seating facilities are more than 30 inches (762 mm) above the floor or grade below. Where the seatboards are adjacent to the perimeter, *guard* height shall be 42 inches (1067 mm) high minimum, measured from the seatboard. Where the seats are self-rising, *guard* height shall be 42 inches (1067 mm) high minimum, measured from the floor surface. Where there is an *aisle* between the seating and the perimeter, the *guard* height shall be measured in accordance with Section 1015.3.

Exceptions:

1. *Guards* that impact sightlines shall be permitted to comply with Section 1030.17.3.
2. *Bleachers*, *grandstands* and *folding and telescopic seating* shall not be required to have perimeter *guards* where the seating is located adjacent to a wall and the space between the wall and the seating is less than 4 inches (102 mm).

1030.17.2 Cross aisles. Cross *aisles* located more than 30 inches (762 mm) above the floor or grade below shall have *guards* in accordance with Section 1015.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross *aisle* and the adjacent floor or grade below, *guards* not less than 26 inches (660 mm) above the *aisle* floor shall be provided.

Exception: Where the backs of seats on the front of the cross *aisle* project 24 inches (610 mm) or more above the adjacent floor of the *aisle*, a *guard* need not be provided.

1030.17.3 Sightline-constrained guard heights. Unless subject to the requirements of Section 1030.17.4, a fascia or railing system in accordance with the *guard* requirements of Section 1015 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating.

1030.17.4 Guards at the end of aisles. A fascia or railing system complying with the *guard* requirements of Section 1015 shall be provided for the full width of the *aisle* where the foot of the *aisle* is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be not less than 36 inches (914 mm) high and shall provide not less than 42 inches (1067 mm) measured diagonally between the top of the rail and the *nosing* of the nearest tread.

SECTION 1031
EMERGENCY ESCAPE AND RESCUE

1031.1 General. *Emergency escape and rescue openings* shall comply with the requirements of this section.

[S] 1031.2 Where required. In addition to the *means of egress* required by this chapter, *emergency escape and rescue openings* shall be provided in the following occupancies:

1. Group R-2 occupancies located in stories with only one *exit* or *access* to only one *exit* as permitted by Tables 1006.3.4(1) and 1006.3.4(2).

2. Buildings designed with a single exit according to Section 1006.3.4, condition 7.

((~~2~~)) 3. Group R-3 and R-4 occupancies.

1031.2.1 Where required. ((~~*Basements*~~)) Where required by Section 1030.1, *basements* and sleeping rooms below the fourth *story above grade plane* shall have not fewer than one *emergency escape and rescue opening* in accordance with this section. Where *basements* contain one or more sleeping rooms, an *emergency escape and rescue opening* shall be required in each sleeping room, but shall not be required in adjoining areas of the *basement*. Such openings shall open directly into a *public way* or to a *yard* or *court* that opens to a *public way*.

Exceptions:

1. *Basements* with a ceiling height of less than 80 inches (2032 mm) shall not be required to have *emergency escape and rescue openings*.
2. *Emergency escape and rescue openings* are not required from *basements* or sleeping rooms that have an *exit* door or *exit access* door that opens directly into a *public way* or to a *yard*, court or exterior egress balcony that opens to a *public way*.
3. *Basements* without *habitable spaces* and having not more than 200 square feet (18.6 m^2) in floor area shall not be required to have *emergency escape and rescue openings*.
4. *Storm shelters* are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Within individual *dwelling* and *sleeping units* in Groups R-2 and R-3, where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, *sleeping rooms* in *basements* shall not be required to have *emergency escape and rescue openings* provided that the basement has one of the following:
   5.1. One *means of egress* and one *emergency escape and rescue opening*.
   5.2. Two *means of egress*.

((~~1031.2.1~~)) 1031.2.2 Operational constraints and opening control devices. *Emergency escape and rescue openings* shall be operational from inside the room without the use of keys or tools. Window-opening control devices complying with ASTM F2090 shall be permitted for use on windows serving as a required *emergency escape and rescue opening*.

1031.3 Emergency escape and rescue openings. *Emergency escape and rescue openings* shall comply with Sections 1031.3.1 through 1031.3.3.

1031.3.1 Minimum size. *Emergency escape and rescue openings* shall have a minimum net clear opening of 5.7 square feet (0.53 m^2).

Exception: The minimum net clear opening for grade-floor *emergency escape and rescue openings* shall be 5 square feet (0.46 m^2).

1031.3.2 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

1031.3.3 Maximum height from floor. *Emergency escape and rescue openings* shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

1031.4 Emergency escape and rescue doors. Where a door is provided as the required *emergency escape and rescue opening*, it shall be a swinging door or a sliding door.

1031.5 Area wells. An *emergency escape and rescue opening* with the bottom of the clear opening below the adjacent grade shall be provided with an area well in accordance with Sections 1031.5.1 through 1031.5.3.

1031.5.1 Minimum size. The minimum horizontal area of the area well shall be 9 square feet (0.84 m^2), with a horizontal projection and width of not less than 36 inches (914 mm). The area well shall allow the *emergency escape and rescue opening* to be fully opened.

Exception: The ladder or steps required by Section 1031.5.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

1031.5.2 Ladders or steps. Area wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an *approved* permanently affixed ladder or steps. The ladder or steps shall not be obstructed by the *emergency escape and rescue opening* when the window or door is in the open position. Ladders or steps required by this section shall not be required to comply with Section 1011.

1031.5.2.1 Ladders. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the area well.

CHAPTER 11

ACCESSIBILITY

Note: The Seattle Department of Construction and Inspections (SDCI) does not have authority to enforce or interpret federal accessibility requirements of the Americans with Disabilities Act (ADA) and the Fair Housing Act. Approval of a building by SDCI does not mean that federal accessibility requirements are satisfied.

User note:

About this chapter: *Chapter 11 contains provisions that set forth requirements for accessibility of buildings and their associated sites and facilities for people with physical disabilities. The fundamental philosophy of the code on the subject of accessibility is that everything is required to be accessible. This is reflected in the basic applicability requirement (see Section 1103.1). The code's scoping requirements then address the conditions under which accessibility is not required in terms of exceptions to this general mandate. While the IBC contains scoping provisions for accessibility (for example, what, where and how many), ICC A117.1, Accessible and Usable Buildings and Facilities, is the referenced standard for the technical provisions (in other words, how). Accessibility criteria for existing buildings are addressed in the* International Existing Building Code®. *The* International Residential Code® *references Chapter 11 for accessibility provisions; therefore, this chapter may be applicable to housing covered under the* International Residential Code*. The provisions in the I-Codes are intended to meet or exceed the requirements in the federal accessibility requirement found in the Americans with Disabilities Act and the Fair Housing Act.*

There are many accessibility issues that not only benefit people with disabilities, but also provide a tangible benefit to people without disabilities. This type of requirement can be set forth in the code as generally applicable without necessarily identifying it specifically as an accessibility-related issue. Such a requirement would then be considered as having been "mainstreamed." For example, visible alarms are located in Chapter 9 and accessible means of egress and ramp requirements are addressed in Chapter 10.

SECTION 1101
GENERAL

[S] 1101.1 Scope. The provisions of this chapter shall control the design and construction of facilities for accessibility. ((~~for individuals with disabilities.~~))

SECTION 1102
COMPLIANCE

[W] 1102.1 Design. Buildings and facilities shall be designed and constructed to be *accessible* in accordance with this code and ICC A117.1, except those portions of ICC A117.1 amended by this section.

1102.1.1 (ICC A117.1 Section 404.2.8) Door opening force. Fire doors and doors or gates required to be equipped with panic hardware, break away features or other factors requiring higher opening force for safety reasons shall have the minimum opening force allowable in scoping provisions adopted by the appropriate administrative authority. For other doors or gates, the force for pushing or pulling open doors or gates shall be as follows:

1. Interior hinged door: 5.0 pounds (22.2 N) maximum.
2. Interior sliding or folding doors: 5.0 pounds (22.2 N) maximum.
3. Exterior hinged, sliding or folding door: 10 pounds (44.5 N) maximum.

Exception: The force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position shall not apply to panic hardware, delayed egress devices or fire-rated hardware.

1102.1.2 (ICC A117.1 Section 603.6) Operable parts. Operable parts on drying equipment, towel or cleansing product dispensers, and disposal fixtures shall comply with ICC A117.1 Table 603.6.

1102.1.3 (ICC A117.1 Section 604.6) Flush controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with ICC A117.1 Section 309, except the maximum height above the floor shall be 44 inches (1118 mm). Flush controls shall be located on the open side of the water closet.

Exception: In ambulatory accessible compartments complying with ICC A117.1 Section 604.10, flush controls are permitted to be located on either side of the water closet.

1102.1.4 (ICC A117.1 Section 703.6.3.1) International Symbol of Accessibility. Where the International Symbol of Accessibility is required, it shall be proportioned complying with ICC A117.1 Figure 703.6.3.1. All interior and exterior signs depicting the International Symbol of Accessibility shall be white on a blue background.

1102.1.5 (ICC A117.1 Section 502.2) Vehicle space size. Car and van parking spaces shall be 96 inches (2440 mm) minimum in width.

1102.1.6 (ICC A117.1 Section 502.4.2) Access aisle width. Access aisles serving car parking spaces shall be 60 inches (1525 mm) minimum in width. Access aisles serving van parking spaces shall be 96 inches (2440 mm) minimum in width.

1102.1.7 (ICC A117.1 Section 502.7) Identification. Accessible parking spaces shall be indicated by a vertical sign. The signs shall include the International Symbol of Accessibility complying with subsection 703.6.3.1. Such symbol shall be white on a blue background. Signs identifying van parking spaces shall contain the designation "van accessible." The sign may include additional language such as, but not limited to, an indication of the amount of the monetary penalty defined in RCW 46.19.050 for parking in the space without a valid permit. A vertical "no parking" sign shall be erected at the head of each access aisle located adjacent to an accessible parking space. The sign may include additional language such as, but not limited to, an indication of any penalty for parking in an access aisle. Such signs shall be 60 inches (1525 mm) minimum above the floor of the parking space, measured to the bottom of the sign.

SECTION 1103
SCOPING REQUIREMENTS

1103.1 Where required. *Sites*, buildings, *structures, facilities*, elements and spaces, temporary or permanent, shall be accessible to individuals with disabilities.

1103.2 General exceptions. *Sites*, buildings, *structures, facilities*, elements and spaces shall be exempt from this chapter to the extent specified in this section.

[S] 1103.2.1 Specific requirements. *Accessibility* is not required in buildings and *facilities*, or portions thereof, to the extent permitted by Sections 1104 through ((~~1112~~)) 1115.

1103.2.2 Employee work areas. Spaces and elements within *employee work areas* shall only be required to comply with Sections 907.5.2.3.1, 1009 and 1104.3.1 and shall be designed and constructed so that individuals with disabilities can approach, enter and exit the work area. Work areas, or portions of work areas, other than raised courtroom stations in accordance with Section 1109.4.1.4, that are less than 300 square feet (30 m^2) in area and located 7 inches (178 mm) or more above or below the ground or finished floor where the change in elevation is essential to the function of the space shall be exempt from all requirements.

1103.2.3 Detached dwellings. Detached one- and two- family *dwellings*, their accessory structures and their associated *sites* and *facilities* are not required to comply with this chapter.

1103.2.4 Utility buildings. Group U occupancies are not required to comply with this chapter other than the following:

1. In agricultural buildings, access is required to paved work areas and areas open to the general public.
2. *Private garages* or carports that contain required accessible parking.

1103.2.5 Construction sites. Structures, *sites* and equipment directly associated with the actual processes of construction including, but not limited to, scaffolding, bridging, materials hoists, materials storage or construction trailers are not required to comply with this chapter.

1103.2.6 Raised areas. Raised areas used primarily for purposes of security, life safety or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers or lifeguard stands are not required to comply with this chapter.

1103.2.7 Limited access spaces. Spaces accessed only by ladders, catwalks, crawl spaces, freight elevators or very narrow passageways are not required to comply with this chapter.

1103.2.8 Areas in places of religious worship. Raised or lowered areas, or portions of areas, in *places of religious worship* that are less than 300 square feet (30 m^2) in area and located 7 inches (178 mm) or more above or below the finished floor and used primarily for the performance of religious ceremonies are not required to comply with this chapter.

1103.2.9 Equipment spaces. Spaces frequented only by service personnel for maintenance, repair or occasional monitoring of equipment are not required to comply with this chapter.

1103.2.10 Highway tollbooths. Highway tollbooths where the access is provided only by bridges above the vehicular traffic or underground tunnels are not required to comply with this chapter.

1103.2.11 Residential Group R-1. Buildings of Group R-1 containing not more than five *sleeping units* for rent or hire that are also occupied as the residence of the proprietor are not required to comply with this chapter.

1103.2.12 Day care facilities. Where a day care facility is part of a *dwelling unit*, only the portion of the structure utilized for the day care facility is required to comply with this chapter.

1103.2.13 Detention and correctional facilities. In detention and correctional facilities, common use areas that are used only by inmates or detainees and security personnel, and that do not serve holding *cells* or housing *cells* required to be *Accessible units*, are not required to comply with this chapter.

1103.2.14 Walk-in coolers and freezers. Walk-in cooler and freezer equipment accessed only from *employee work areas* is not required to comply with this chapter.

SECTION 1104
ACCESSIBLE ROUTE

1104.1 Site arrival points. At least one *accessible* route within the *site* shall be provided from public transportation stops, accessible parking, accessible passenger loading zones, and public streets or sidewalks to the accessible building entrance served.

Exception: Other than in buildings or *facilities* containing or serving *Type B units*, an *accessible route* shall not be required between *site* arrival points and the building or *facility* entrance if the only means of access between them is a vehicular way not providing for pedestrian access.

1104.2 Within a site. At least one *accessible* route shall connect accessible buildings, accessible facilities, accessible elements and accessible spaces that are on the same *site*.

Exceptions:

1. An *accessible* route is not required between accessible buildings, accessible facilities, accessible elements and accessible spaces that have, as the only means of access between them, a vehicular way not providing for pedestrian access.
2. An *accessible route* to recreational facilities shall only be required to the extent specified in Section 1111.

1104.3 Connected spaces. Where a building or portion of a building is required to be *accessible*, at least one *accessible* route shall be provided to each portion of the building, to accessible building entrances connecting accessible *pedestrian walkways* and to the *public way*.

Exceptions:

1. *Stories* and *mezzanines* exempted by Section 1104.4.
2. In a building, room or space used for assembly purposes with *fixed seating*, an *accessible route* shall not be required to serve levels where *wheelchair spaces* are not provided.
3. Vertical access to elevated employee work stations within a courtroom complying with Section 1109.4.1.4.
4. An *accessible route* to recreational facilities shall only be required to the extent specified in Section 1111.

1104.3.1 Employee work areas. *Common use circulation paths* within *employee work areas* shall be *accessible routes*.

Exceptions:

1. *Common use circulation paths*, located within *employee work areas* that are less than 1,000 square feet (93 m^2) in size and defined by permanently installed partitions, counters, casework or furnishings, shall not be required to be *accessible routes*.
2. *Common use circulation paths*, located within *employee work areas*, that are an integral component of equipment, shall not be required to be *accessible routes*.
3. *Common use circulation paths*, located within exterior *employee work areas* that are fully exposed to the weather, shall not be required to be *accessible routes*.

1104.3.2 Press boxes. Press boxes in a building, room or space used for assembly purposes shall be on an *accessible route*.

Exceptions:

1. An *accessible route* shall not be required to press boxes in *bleachers* that have a single point of entry from the *bleachers*, provided that the aggregate area of all press boxes for each playing field is not more than 500 square feet (46 m^2).
2. An *accessible route* shall not be required to free-standing press boxes that are more than 12 feet (3660 mm) above grade provided that the aggregate area of all press boxes for each playing field is not more than 500 square feet (46 m^2).

[S] 1104.4 Multistory buildings and facilities. At least one *accessible* route shall connect each accessible *story, mezzanine* and occupied roofs in multilevel buildings and *facilities*.

Exceptions:

1. An *accessible* route is not required to *stories, mezzanines* ((~~and~~)) or occupied roofs that have an aggregate area of not more than 3,000 square feet (278.7 m^2) and are located above ((~~and~~)) or below accessible levels. This exception shall not apply to:
   1.1. Multiple tenant facilities of Group M occupancies containing five or more tenant spaces used for the sales or rental of goods and where at least one such tenant space is located on a floor level above or below the accessible levels.
   1.2. *Stories* or *mezzanines* containing offices of health care providers (Group B or I).
   1.3. Passenger transportation facilities and airports (Group A-3 or B).
   1.4. Government buildings.
   1.5. Structures with four or more dwelling units.
2. *Stories*, *mezzanines* or occupied roofs that do not contain accessible elements or other spaces as determined by Section 1108 or 1109 are not required to be served by an accessible route from an *accessible* level.
3. In air traffic control towers, an *accessible route* is not required to serve the cab and the floor immediately below the cab.
4. Where a two-story building or facility has one *story* or *mezzanine* with an *occupant load* of five or fewer persons that does not contain *public use* space, that *story* or *mezzanine* shall not be required to be connected by an *accessible route* to the *story* above or below.

1104.5 Location. *Accessible routes* shall coincide with or be located in the same area as a general *circulation path*. Where the *circulation path* is interior, the *accessible route* shall be interior. Where only one *accessible route* is provided, the *accessible route* shall not pass through kitchens, storage rooms, restrooms, closets or similar spaces.

Exceptions:

1. *Accessible routes* from parking garages contained within and serving *Type B units* are not required to be interior.
2. A single *accessible route* is permitted to pass through a kitchen or storage room in an *Accessible unit, Type A unit* or *Type B unit*.

1104.6 Security barriers. Security barriers including, but not limited to, security bollards and security check points shall not obstruct a required *accessible route* or accessible means of egress.

Exception: Where security barriers incorporate elements that cannot comply with these requirements, such as certain metal detectors, fluoroscopes or other similar devices, the *accessible route* shall be permitted to be provided adjacent to security screening devices. The *accessible route* shall permit persons with disabilities passing around security barriers to maintain visual contact with their personal items to the same extent provided others passing through the security barrier.

[S] 1104.7 Raised platforms. In banquet rooms or spaces where a head table or speaker's lectern is located on a raised platform, an *accessible route* shall be provided to the platform.

SECTION 1105
ACCESSIBLE ENTRANCES

1105.1 Public entrances. In addition to accessible entrances required by Sections 1105.1.2 through 1105.1.8, at least 60 percent of all *public entrances* shall be *accessible*.

Exceptions:

1. An accessible entrance is not required to areas not required to be *accessible*.
2. Loading and *service entrances* that are not the only entrance to a tenant space.

1105.1.1 Automatic doors. In facilities with the occupancies and building *occupant loads* indicated in Table 1105.1.1, *public entrances* that are required to be *accessible* shall have one door be either a full *power-operated* door or a *low-energy power-operated door*. Where the *public entrance* includes a vestibule, at least one door into and one door out of the vestibule shall meet the requirements of this section.

TABLE 1105.1.1
PUBLIC ENTRANCE WITH POWER-OPERATED DOOR[a]

OCCUPANCY	BUILDING OCCUPANT LOAD GREATER THAN
A-1, A-2, A-3, A-4	300
B, M, R-1	500

a. In mixed-use facilities where the total sum of the building occupant load is greater than those listed, the most restrictive building occupant load shall apply.

1105.1.2 Parking garage entrances. Where provided, direct access for pedestrians from parking structures to buildings or facility entrances shall be *accessible*.

1105.1.3 Entrances from tunnels or elevated walkways. Where direct access is provided for pedestrians from a pedestrian tunnel or elevated walkway to a building or facility, at least one entrance to the building or facility from each tunnel or walkway shall be *accessible*.

1105.1.4 Restricted entrances. Where *restricted entrances* are provided to a building or facility, at least one *restricted entrance* to the building or facility shall be *accessible*.

1105.1.5 Entrances for inmates or detainees. Where entrances used only by inmates or detainees and security personnel are provided at judicial facilities, detention facilities or correctional facilities, at least one such entrance shall be *accessible*.

1105.1.6 Service entrances. If a *service entrance* is the only entrance to a building or a tenant space in a facility, that entrance shall be *accessible*.

1105.1.7 Tenant spaces. At least one accessible entrance shall be provided to each tenant in a facility.

Exception: An accessible entrance is not required to *self-service storage facilities* that are not required to be *accessible*.

1105.1.8 Dwelling units and sleeping units. At least one accessible entrance shall be provided to each *dwelling unit* and *sleeping unit* in a facility.

Exception: An accessible entrance is not required to *dwelling units* and *sleeping units* that are not required to be *Accessible units, Type A units* or *Type B units*.

SECTION 1106
PARKING AND PASSENGER LOADING FACILITIES

1106.1 General. Parking shall comply with Sections 1106.2 through 1106.8. Passenger loading zones shall comply with Section 1106.9.

1106.2 Required. Where parking is provided, accessible parking spaces shall be provided in compliance with Table 1106.2, except as required by Sections 1106.3 through 1106.5. Where more than one parking facility is provided on a site, the number of parking spaces required to be *accessible* shall be calculated separately for each parking facility.

Exception: This section does not apply to parking spaces used exclusively for buses, trucks, other delivery vehicles, law enforcement vehicles or vehicular impound and motor pools where lots accessed by the public are provided with an accessible passenger loading zone.

TABLE 1106.2
ACCESSIBLE PARKING SPACES

TOTAL PARKING SPACES PROVIDED IN PARKING FACILITIES	REQUIRED MINIMUM NUMBER OF ACCESSIBLE SPACES
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1,000	2% of total
1,001 and over	20, plus one for each 100, or fraction thereof, over 1,000

[W] 1106.3 Groups I-1, R-1, R-2, R-3 and R-4. *Accessible* parking spaces shall be provided in Group I-1, R-1, R-2, R-3 and R-4 occupancies in accordance with Items 1 through 4 as applicable.

1. In Group R-2, R-3 and R-4 occupancies that are required to have Accessible, Type A or *Type B dwelling units* or *sleeping units*, at least 2 percent, but not less than one, of each type of parking space provided shall be accessible.
2. In Group I-1 and R-1 occupancies, accessible parking shall be provided in accordance with Table 1106.2.
3. Where at least one parking space is provided for each *dwelling unit* or *sleeping unit*, at least one *accessible* parking space shall be provided for each *Accessible* and *Type A unit*.

4. Where parking is provided within or beneath a building, *accessible* parking spaces shall be provided within or beneath the building.

1106.4 Hospital outpatient facilities. At least 10 percent, but not less than one, of care recipient and visitor parking spaces provided to serve *hospital* outpatient facilities shall be *accessible*.

1106.5 Rehabilitation facilities and outpatient physical therapy facilities. At least 20 percent, but not less than one, of the portion of care recipient and visitor parking spaces serving rehabilitation facilities specializing in treating conditions that affect mobility and outpatient physical therapy facilities shall be *accessible*.

1106.6 Van spaces. For every six or fraction of six accessible parking spaces, at least one shall be a van-accessible parking space.

Exception: In Group U *private garages* that serve Group R-2 and R-3 occupancies, van-accessible spaces shall be permitted to have vehicular routes, entrances, parking spaces and access aisles with a minimum vertical clearance of 7 feet (2134 mm).

[W] 1106.7 Location. Accessible parking spaces shall be located on the shortest accessible route of travel from adjacent parking to an accessible building entrance. In parking facilities that do not serve a particular building, accessible parking spaces shall be located on the shortest route to an accessible pedestrian entrance to the parking facility. Where buildings have multiple accessible entrances with adjacent parking, *accessible* parking spaces shall be dispersed and located near the accessible entrances. Wherever practical, the *accessible route* shall not cross lanes of vehicular traffic. Where crossing traffic lanes is necessary, the route shall be designated and marked as a crosswalk.

Exceptions:

1. In multilevel parking structures, van-accessible parking spaces are permitted on one level.
2. *Accessible* parking spaces shall be permitted to be located in different parking facilities if substantially equivalent or greater accessibility is provided in terms of distance from an *accessible* entrance or entrances, parking fee and user convenience.

1106.8 Parking meters and pay stations. Where parking meters and pay stations serve accessible parking spaces, such parking meters and pay stations shall be *accessible*.

1106.9 Passenger loading zones. Passenger loading zones shall be *accessible*.

1106.9.1 Continuous loading zones. Where passenger loading zones are provided, one passenger loading zone in every continuous 100 linear feet (30.4 m) maximum of loading zone space shall be *accessible*.

1106.9.2 Medical facilities. A passenger loading zone shall be provided at an accessible entrance to licensed medical and long-term care facilities where people receive physical or medical treatment or care and where the period of stay exceeds 24 hours.

1106.9.3 Valet parking. A passenger loading zone shall be provided at valet parking services.

1106.9.4 Mechanical access parking garages. Mechanical access parking garages shall provide at least one passenger loading zone at vehicle drop-off and vehicle pick-up areas.

SECTION 1107
MOTOR-VEHICLE-RELATED FACILITIES

1107.1 General. Electrical vehicle charging stations shall comply with Section 1107.2. Fuel-dispensing systems shall comply with Section 1107.3.

[W] 1107.2 Electrical vehicle charging stations. Electrical vehicle charging stations shall comply with Sections 1107.2.1 and 1107.2.2.

Exception: Electrical vehicle charging stations provided to serve Group ((~~R-2,~~)) R-3 and R-4 occupancies are not required to comply with this section.

[S] 1107.2.1 Number of accessible vehicle spaces. ((~~Not less than 5 percent of vehicle spaces on the site served by electrical vehicle charging systems, but not fewer than one for each type of electric vehicle charging system, shall be accessible.~~)) See Section 625.27 of the *Seattle Electrical Code*.

1107.2.2 Vehicle space size. Accessible vehicle spaces shall comply with the requirements for a van accessible parking space that is 132 inches (3350 mm) minimum in width with an adjoining access aisle that is 60 inches (1525 mm) minimum in width.

1107.3 Fuel-dispensing systems. Fuel-dispensing systems shall be *accessible*.

[S] SECTION 1108
DWELLING UNITS, ((~~AND~~)) SLEEPING UNITS AND TRANSIENT LODGING FACILITIES

1108.1 General. In addition to the other requirements of this chapter, occupancies having *dwelling units* or *sleeping units* shall be provided with accessible features in accordance with this section.

1108.2 Design. *Dwelling units* and *sleeping units* that are required to be *Accessible units, Type A units* and *Type B units* shall comply with the applicable portions of Chapter 11 of ICC A117.1. Units required to be *Type A units* are permitted to be designed and constructed as *Accessible units*. Units required to be *Type B units* are permitted to be designed and constructed as *Accessible units* or as *Type A units*.

1108.3 Accessible spaces. Rooms and spaces available to the general public or available for use by residents and serving Accessible units, *Type A units* or *Type B units* shall be *accessible*. *Accessible* spaces shall include toilet and bathing rooms, kitchen, living and dining areas and any exterior spaces, including patios, terraces and balconies.

Exceptions:

1. *Stories* and *mezzanines* exempted by Section 1108.4.
2. Recreational facilities in accordance with Section 1111.2.
3. Exterior decks, patios or balconies that are part of *Type B units* and have impervious surfaces, and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the unit.

[W] 1108.4 Accessible route. Not fewer than one accessible route shall connect accessible building or facility entrances with the primary entrance of each *Accessible unit, Type A unit* and *Type B unit* within the building or facility and with those exterior and interior spaces and facilities that serve the units.

Exceptions:

1. If due to circumstances outside the control of the owner, either the slope of the finished ground level between accessible facilities and buildings exceeds one unit vertical in 12 units horizontal (1:12), or where physical barriers or legal restrictions prevent the installation of an *accessible route*, a vehicular route with parking that complies with Section 1106 at each *public* or common use facility or building is permitted in place of the *accessible route*.
2. In Group I-3 facilities, an *accessible route* is not required to connect *stories* or *mezzanines* where *Accessible units*, all common use areas serving *Accessible units* and all *public use* areas are on an *accessible route*.
3. In Group R-2 facilities with *Type A units* complying with Section 1108.6.2.2.1, an *accessible route* is not required to connect *stories* or *mezzanines* where *Type A units*, all common use areas serving *Type A units* and all public use areas are on an *accessible route*.
4. In other than Group R-2 *dormitory* housing provided by places of education, in Group R-2 facilities with *Accessible units* complying with Section 1108.6.2.3.1, an *accessible route* is not required to connect stories or *mezzanines* where *Accessible units*, all common use areas serving *Accessible units* and all *public use* areas are on an *accessible* route.
5. In Group R-1, an *accessible route* is not required to connect *stories* or *mezzanines* within individual units, provided the *accessible* level meets the provisions for *Accessible units* and sleeping accommodations for two persons minimum and a toilet facility are provided on that level.
6. In congregate residences in Groups R-3 and R-4, an *accessible route* is not required to connect *stories* or *mezzanines* where *Accessible units* or *Type B units*, all common use areas serving *Accessible units* and *Type B units* and all *public use* areas serving *Accessible units* and *Type B units* are on an *accessible route*.
7. An *accessible route* between *stories* is not required where *Type B units* are exempted by Section 1108.7.

1108.5 Group I. *Accessible units* and *Type B units* shall be provided in Group I occupancies in accordance with Sections 1108.5.1 through 1108.5.5.

1108.5.1 Group I-1. *Accessible units* and *Type B units* shall be provided in Group I-1 occupancies in accordance with Sections 1108.5.1.1 and 1108.5.1.3.

1108.5.1.1 Accessible units. In Group I-1, Condition 1, at least 4 percent, but not less than one, of the *dwelling units* and *sleeping units* shall be *Accessible units*. Accessible dwelling units and sleeping units shall be dispersed among the various classes of units.

Exceptions:

1. Water closets shall not be required to comply with ICC A117.1 where such water closets comply with Section 1110.2.2, in not more than 50 percent of the *Accessible units*.
2. Roll-in-type showers shall not be required to comply with ICC A117.1 where roll-in-type showers comply with Section 1110.2.3, in not more than 50 percent of the *Accessible units*.

1108.5.5.3 Medical care facilities. Patient *sleeping units* or *cells* required to be *Accessible units* in *medical care* facilities shall be provided in addition to any medical isolation *cells* required to comply with Section 1108.5.5.2.

1108.6 Group R. *Accessible units*, *Type A units* and *Type B units* shall be provided in Group R occupancies in accordance with Sections 1108.6.1 through 1108.6.4.

Interpretation I1108.6: Accessible and Type A units shall be apportioned among efficiency dwelling units, single bedroom units and multiple bedroom units, in proportion to the numbers of such units in the building.

1108.6.1 Group R-1. *Accessible units* and *Type B units* shall be provided in Group R-1 occupancies in accordance with Sections 1108.6.1.1 and 1108.6.1.2.

1108.6.1.1 Accessible units. *Accessible dwelling units* and *sleeping units* shall be provided in accordance with Table 1108.6.1.1. On a multiple-building site, where structures contain more than 50 *dwelling units* or *sleeping units*, the number of *Accessible units* shall be determined per structure. On a multiple-building site, where structures contain 50 or fewer *dwelling units* or *sleeping units*, all *dwelling units* and *sleeping units* on a site shall be considered to determine the total number of *Accessible units*. *Accessible units* shall be dispersed among the various classes of units.

TABLE 1108.6.1.1
ACCESSIBLE DWELLING UNITS AND SLEEPING UNITS

TOTAL NUMBER OF UNITS PROVIDED	MINIMUM REQUIRED NUMBER OF ACCESSIBLE UNITS WITHOUT ROLL-IN SHOWERS	MINIMUM REQUIRED NUMBER OF ACCESSIBLE UNITS WITH ROLL-IN SHOWERS	TOTAL NUMBER OF REQUIRED ACCESSIBLE UNITS
1 to 25	1	0	1
26 to 50	2	0	2
51 to 75	3	1	4
76 to 100	4	1	5
101 to 150	5	2	7
151 to 200	6	2	8
201 to 300	7	3	10
301 to 400	8	4	12
401 to 500	9	4	13
501 to 1,000	2% of total	1% of total	3% of total
Over 1,000	20, plus 1 for each 100, or fraction thereof, over 1,000	10 plus 1 for each 100, or fraction thereof, over 1,000	30 plus 2 for each 100, or fraction thereof, over 1,000

1108.6.1.2 Type B units. In structures with four or more *dwelling units* or *sleeping units intended to be occupied as a residence*, every *dwelling unit* and *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

1108.6.2 Group R-2. *Accessible units, Type A units* and *Type B units* shall be provided in Group R-2 occupancies in accordance with Sections 1108.6.2.1 through 1108.6.2.3.

1108.6.2.1 Live/work units. In *live/work units* constructed in accordance with Section 508.5, the nonresidential portion is required to be *accessible*. In a structure where there are four or more *live/work units intended to be occupied as a residence*, the residential portion of the *live/work unit* shall be a *Type B unit*.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

1108.6.2.2 Apartment houses, monasteries and convents. *Type A units* and *Type B units* shall be provided in apartment houses, monasteries and convents in accordance with Sections 1108.6.2.2.1 and 1108.6.2.2.2. Bedrooms in monasteries and convents shall be counted as units for the purpose of determining the number of units. Where the bedrooms are grouped in *sleeping units*, only one bedroom in each *sleeping unit* shall count toward the number of required *Type A units*.

[W] 1108.6.2.2.1 Type A units. In Group R-2 occupancies containing more than ((~~20~~)) 10 *dwelling units* or *sleeping units*, at least ((~~2~~)) 5 percent, but not less than one, of the units shall be a *Type A unit*. All ((~~Group R-2~~)) units on a site shall be considered to determine the total number of units and the required number of *Type A units*. *Type A units* shall be dispersed among the various classes of units, as described in Section 1108.6. Bedrooms in monasteries and convents shall be counted as *sleeping units* for the purpose of determining the number of units. Where the *sleeping units* are grouped into suites, only one *sleeping unit* in each suite shall count towards the number of required *Type A units*.

Exceptions:

1. The number of *Type A units* is permitted to be reduced in accordance with Section 1108.7.

2. *Existing structures* on a site shall not contribute to the total number of units on a site.

1108.6.2.2.2 Type B units. Where there are four or more *dwelling units* or *sleeping units intended to be occupied as a residence* in a single structure, every *dwelling unit* and *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

1108.6.2.3 Group R-2 other than live/work units, apartment houses, monasteries and convents. In Group R-2 occupancies, other than *live/work units*, apartment houses, monasteries and convents falling within the scope of Sections 1108.6.2.1 and 1108.6.2.2, *Accessible units* and *Type B units* shall be provided in accordance with Sections 1108.6.2.3.1 and 1108.6.2.3.2. Bedrooms within *congregate living facilities*, *dormitories*, sororities, fraternities and *boarding houses* shall be counted as *sleeping units* for the purpose of determining the number of units. Where the *bedrooms* are grouped into *dwelling* or *sleeping units*, only one *bedroom* in each *dwelling* or *sleeping unit* shall be permitted to count toward the number of required *Accessible units*.

1108.6.2.3.1 Accessible units. *Accessible dwelling units* and *sleeping units* shall be provided in accordance with Table 1108.6.1.1.

1108.6.2.3.2 Type B units. Where there are four or more *dwelling units* or *sleeping units intended to be occupied as a residence* in a single structure, every *dwelling unit* and every *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

1108.6.3 Group R-3. In Group R-3 occupancies where there are four or more *dwelling units* or *sleeping units intended to be occupied as a residence* in a single structure, every *dwelling unit* and *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*. Bedrooms within *congregate living facilities*, *dormitories*, sororities, fraternities, and *boarding houses* shall be counted as *sleeping units* for the purpose of determining the number of units.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

[W] 1108.6.4 Group R-4. *Accessible units* and *Type B units* shall be provided in Group R-4 occupancies in accordance with Sections 1108.6.4.1 and 1108.6.4.2. Bedrooms in Group R-4 facilities shall be counted as *sleeping units* for the purpose of determining the number of units.

1108.6.4.1 Accessible units. In Group R-4, Condition 1, at least one of the *sleeping units* shall be an *Accessible unit*. In Group R-4, Condition 2, at least two of the *sleeping units* shall be an *Accessible unit*.

1108.6.4.2 Type B units. In structures with four or more *sleeping units intended to be occupied as a residence*, every *sleeping unit intended to be occupied as a residence* shall be a *Type B unit*.

Exception: The number of *Type B units* is permitted to be reduced in accordance with Section 1108.7.

1108.7 General exceptions. Where specifically permitted by Section 1108.5 or 1108.6, the required number of *Type A units* and *Type B units* is permitted to be reduced in accordance with Sections 1108.7.1 through 1108.7.5.

1108.7.1 Structures without elevator service. Where elevator service is not provided in a structure, only the *dwelling units* and *sleeping units* that are located on stories indicated in Sections 1108.7.1.1 and 1108.7.1.2 are required to be *Type A units* and *Type B units*, respectively. The number of *Type A units* shall be determined in accordance with Section 1108.6.2.2.1.

1108.7.1.1 One story with Type B units required. At least one *story* containing *dwelling units* or *sleeping units intended to be occupied as a residence* shall be provided with an accessible entrance from the exterior of the structure and all units *intended to be occupied as a residence* on that *story* shall be *Type B units*.

1108.7.1.2 Additional stories with Type B units. Where stories have entrances not included in determining compliance with Section 1108.7.1.1, and such entrances are proximate to arrival points intended to serve units on that *story*, as indicated in Items 1 and 2, all *dwelling units* and *sleeping units intended to be occupied as a residence* served by that entrance on that *story* shall be *Type B units*.

1. Where the slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance are 10 percent or less.
2. Where the slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance are 10 percent or less.

Where arrival points are not within 50 feet (15 240 mm) of the entrance, the closest arrival point shall be used to determine access unless that arrival point serves the *story* required by Section 1108.7.1.1.

1108.7.2 Multistory units. A *multistory dwelling unit* or *sleeping unit* that is not provided with elevator service is not required to be a *Type B unit*. Where a *multistory unit* is provided with external elevator service to only one floor, the floor

provided with elevator service shall be the primary entry to the unit, shall comply with the requirements for a *Type B unit* and, where provided within the unit, a living area, a kitchen and a toilet facility shall be provided on that floor.

1108.7.3 Elevator service to the lowest story with units. Where elevator service in the building provides an *accessible route* only to the lowest *story* containing *dwelling units* or *sleeping units intended to be occupied as a residence*, only the units on that *story* that are *intended to be occupied as a residence* are required to be *Type B units*.

1108.7.4 Site impracticality. On a site with multiple nonelevator buildings, the number of units required by Section 1108.7.1 to be *Type B units* is permitted to be reduced to a percentage that is equal to the percentage of the entire site having grades, prior to development, that are less than 10 percent, provided that all of the following conditions are met:

1. Not less than 20 percent of the units required by Section 1108.7.1 on the site are *Type B units*.
2. Units required by Section 1108.7.1, where the slope between the building entrance serving the units on that *story* and a pedestrian or vehicular arrival point is not greater than 8.33 percent, are *Type B units*.
3. Units required by Section 1108.7.1, where an elevated walkway is planned between a building entrance serving the units on that *story* and a pedestrian or vehicular arrival point and the slope between them is 10 percent or less, are *Type B units*.
4. Units served by an elevator in accordance with Section 1108.7.3 are *Type B units*.

1108.7.5 Flood hazard areas. *Type A units* and *Type B units* shall not be required for buildings without elevator service that are located in *flood hazard areas* as established in Section 1612.3, where the minimum required elevation of the *lowest floor* or lowest supporting horizontal structural member, as applicable, results in all of the following:

1. A difference in elevation between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15 240 mm) exceeding 30 inches (762 mm).
2. A slope exceeding 10 percent between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15 240 mm).

Where such arrival points are not within 50 feet (15 240 mm) of the primary entrances, the closest arrival points shall be used.

[W] 1108.8 Communication features. Accessible communication features shall be provided in accordance with Sections 1108.8.1 through 1108.8.4.

1108.8.1 Transient lodging. In *transient lodging* facilities, sleeping units with accessible communication features shall be provided in accordance with Table 1108.8. Units required to comply with Table 1108.8 shall be dispersed among the various classes of units.

1108.8.2 Group I-3. In Group I-3 occupancies at least 2 percent, but no fewer than one of the total number of general holding cells and general housing cells equipped with audible emergency alarm systems and permanently installed telephones within the cell, shall comply with Section 1108.8.4.

1108.8.3 Dwelling units and sleeping units. Where *dwelling units* and *sleeping units* are altered or added, the requirements of Section 1108.8 shall apply only to the units being altered or added until the number of units with accessible communication features complies with the minimum number required for new construction.

1108.8.4 Notification devices. Visual notification devices shall be provided to alert room occupants of incoming telephone calls and a door knock or bell. Notification devices shall not be connected to visual alarm signal appliances. Permanently installed telephones shall have volume controls and an electrical outlet complying with ICC 117.1 located within 48 inches (1219 mm) of the telephone to facilitate the use of a TTY.

[W] TABLE 1108.8
DWELLING OR SLEEPING UNITS WITH ACCESSIBLE COMMUNICATION FEATURES

TOTAL NUMBER OF DWELLING OR SLEEPING UNITS PROVIDED	MINIMUM REQUIRED NUMBER OF DWELLING OR SLEEPING UNITS WITH ACCESSIBLE COMMUNICATION FEATURES
1	1
2 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22

[W] TABLE 1108.8—continued
DWELLING OR SLEEPING UNITS WITH ACCESSIBLE COMMUNICATION FEATURES

TOTAL NUMBER OF DWELLING OR SLEEPING UNITS PROVIDED	MINIMUM REQUIRED NUMBER OF DWELLING OR SLEEPING UNITS WITH ACCESSIBLE COMMUNICATION FEATURES
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

SECTION 1109
SPECIAL OCCUPANCIES

1109.1 General. In addition to the other requirements of this chapter, the requirements of Sections 1109.2 through 1109.4 shall apply to specific occupancies.

1109.2 Assembly area seating. A building, room or space used for assembly purposes with *fixed seating* shall comply with Sections 1109.2.1 through 1109.2.5. Lawn seating shall comply with Section 1109.2.6. Assistive listening systems shall comply with Section 1109.2.7. Performance areas viewed from assembly seating areas shall comply with Section 1109.2.8. Dining areas shall comply with Section 1109.2.9.

1109.2.1 Services. If a service or facility is provided in an area that is not *accessible*, the same service or facility shall be provided on an accessible level and shall be *accessible*.

1109.2.2 Wheelchair spaces. In rooms and spaces used for assembly purposes with *fixed seating*, accessible *wheelchair spaces* shall be provided in accordance with Sections 1109.2.2.1 through 1109.2.2.3.

1109.2.2.1 General seating. *Wheelchair spaces* shall be provided in accordance with Table 1109.2.2.1.

TABLE 1109.2.2.1
ACCESSIBLE WHEELCHAIR SPACES

CAPACITY OF SEATING IN ASSEMBLY AREAS	MINIMUM REQUIRED NUMBER OF WHEELCHAIR SPACES
4 to 25	1
26 to 50	2
51 to 100	4
101 to 300	5
301 to 500	6
501 to 5,000	6, plus 1 for each 150, or fraction thereof, between 501 through 5,000
5,001 and over	36 plus 1 for each 200, or fraction thereof, over 5,000

1109.2.2.2 Luxury boxes, club boxes and suites. In each luxury box, club box and suite within arenas, stadiums and *grandstands, wheelchair spaces* shall be provided in accordance with Table 1109.2.2.1.

1109.2.2.3 Other boxes. In boxes other than those required to comply with Section 1109.2.2.2, the total number of *wheelchair spaces* provided shall be determined in accordance with Table 1109.2.2.1. *Wheelchair spaces* shall be located in not less than 20 percent of all boxes provided.

1109.2.3 Companion seats. At least one companion seat shall be provided for each *wheelchair space* required by Sections 1109.2.2.1 through 1109.2.2.3.

1109.2.4 Dispersion of wheelchair spaces in multilevel assembly seating areas. In *multilevel assembly seating* areas, *wheelchair spaces* shall be provided on the main floor level and on one of each two additional floor or *mezzanine* levels. *Wheelchair spaces* shall be provided in each luxury box, club box and suite within assembly facilities.

Exceptions:

1. In *multilevel assembly seating* areas utilized for worship services where the second floor or *mezzanine* level contains 25 percent or less of the total seating capacity, *wheelchair spaces* shall be permitted to all be located on the main level.
2. In *multilevel assembly seating* areas where the second floor or *mezzanine* level provides 25 percent or less of the total seating capacity and 300 or fewer seats, all *wheelchair spaces* shall be permitted to be located on the main level.
3. *Wheelchair spaces* in team or player seating serving *areas of sport activity* are not required to be dispersed.

1109.2.5 Designated aisle seats. At least 5 percent, but not less than one, of the total number of aisle seats provided shall be designated aisle seats and shall be the aisle seats located closest to *accessible routes*.

1109.3 Self-service storage facilities. *Self-service storage facilities* shall provide accessible individual self-storage spaces in accordance with Table 1109.3.

TABLE 1109.3
ACCESSIBLE SELF-SERVICE STORAGE FACILITIES

TOTAL SPACES IN FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE SPACES
1 to 200	5%, but not less than 1
Over 200	10, plus 2% of total number of units over 200

1109.3.1 Dispersion. Accessible individual self-service storage spaces shall be dispersed throughout the various classes of spaces provided. Where more classes of spaces are provided than the number of required accessible spaces, the number of *accessible* spaces shall not be required to exceed that required by Table 1109.3. *Accessible* spaces are permitted to be dispersed in a single building of a multiple-building facility.

1109.4 Judicial facilities. Judicial facilities shall comply with Sections 1109.4.1 and 1109.4.2.

1109.4.1 Courtrooms. Each courtroom shall be accessible and comply with Sections 1109.4.1.1 through 1109.4.1.5.

1109.4.1.1 Jury box. A *wheelchair space* shall be provided within the jury box.

Exception: Adjacent companion seating is not required.

1109.4.1.2 Gallery seating. *Wheelchair spaces* shall be provided in accordance with Table 1109.2.2.1. Designated aisle seats shall be provided in accordance with Section 1109.2.5.

1109.4.1.3 Assistive listening systems. An assistive listening system must be provided. Receivers shall be provided for the assistive listening system in accordance with Section 1109.2.7.1.

1109.4.1.4 Employee work stations. The judge's bench, clerk's station, bailiff's station, deputy clerk's station and court reporter's station shall be located on an *accessible route*. The vertical access to elevated employee work stations within a courtroom is not required at the time of initial construction, provided a *ramp*, lift or elevator can be installed without requiring reconfiguration or extension of the courtroom or extension of the electrical system.

1109.4.1.5 Other work stations. The litigant's and counsel stations, including the lectern, shall be *accessible*.

1109.4.2 Holding cells. Central holding *cells* and court-floor holding *cells* shall comply with Sections 1109.4.2.1 and 1109.4.2.2.

1109.4.2.1 Central holding cells. Where separate central holding *cells* are provided for adult males, juvenile males, adult females or juvenile females, one of each type shall be *accessible*. Where central holding *cells* are provided and are not separated by age or sex, at least one accessible cell shall be provided.

1109.4.2.2 Court-floor holding cells. Where separate court-floor holding *cells* are provided for adult males, juvenile males, adult females or juvenile females, each courtroom shall be served by one accessible cell of each type. Where court-floor holding *cells* are provided and are not separated by age or sex, courtrooms shall be served by at least one accessible cell. *Accessible cells* shall be permitted to serve more than one courtroom.

SECTION 1110
OTHER FEATURES AND FACILITIES

[S] 1110.1 General. *Accessible* building features and facilities shall be provided in accordance with Sections 1110.2 through ((~~1110.16~~)) 1110.20.

Exception: *Accessible units, Type A units* and *Type B units* shall comply with Chapter 10 of ICC A117.1.

[W] 1110.2 Toilet and bathing facilities. Each toilet room and bathing room shall be *accessible*. Where a floor level is not required to be connected by an *accessible route*, the only toilet rooms or bathing rooms provided within the facility shall not be located on the inaccessible floor. Except as provided for in Sections 1110.2.3, 1110.2.4, ((~~and~~)) 1110.2.5, and 1110.2.6 at least one of each type of fixture, element, control or dispenser in each accessible toilet room and bathing room shall be *accessible*.

Exceptions:

1. Toilet rooms or bathing rooms accessed only through a private office, not for *common* or *public use* and intended for use by a single occupant, shall be permitted to comply with the specific exceptions in ICC A117.1.
2. This section is not applicable to toilet and bathing rooms that serve *dwelling units* or *sleeping units* that are not required to be *accessible* by Section 1108.
3. Where multiple single-user all-gender toilet rooms or bathing rooms are clustered at a single location, at least 50 percent ((~~but not less than one room for each use at each cluster~~)) shall be *accessible*.

4. Where no more than one urinal is provided in a toilet room or bathing room, the urinal is not required to be *accessible*.
5. Toilet rooms or bathing rooms that are part of critical care or intensive care patient sleeping rooms serving *Accessible units* are not required to be *accessible*.
6. Toilet rooms or bathing rooms designed for bariatrics patients are not required to comply with the toilet room and bathing room requirement in ICC A117.1. The *sleeping units* served by bariatrics toilet or bathing rooms shall not count toward the required number of Accessible *sleeping units*.
7. Where permitted in Section 1108, in toilet rooms or bathrooms serving Accessible units, water closets designed for assisted toileting shall comply with Section 1110.2.2.
8. Where permitted in Section 1108, in bathrooms serving Accessible units, showers designed for assisted bathing shall comply with Section 1110.2.3.
9. Where toilet facilities are primarily for children's use, required *accessible* water closets, toilet compartments and lavatories shall be permitted to comply with children's provision of ICC A117.1.

1110.2.1 Family or assisted-use toilet and bathing rooms. In assembly and mercantile occupancies, an accessible family or assisted-use toilet room shall be provided where an aggregate of six or more male and female water closets is required. In buildings of mixed occupancy, only those water closets required for the assembly or mercantile occupancy shall be used to determine the family or assisted-use toilet room requirement. In recreational facilities where separate-sex bathing rooms are provided, an accessible family or assisted-use bathing room shall be provided. Fixtures located within family or assisted-use toilet and bathing rooms shall be included in determining the number of fixtures provided in an occupancy.

Exception: Where each separate-sex bathing room has only one shower or bathtub fixture, a family or assisted-use bathing room is not required.

1110.2.1.1 Standard. Family or assisted-use toilet and bathing rooms shall comply with Sections 1110.2.1.2 through 1110.2.1.6.

1110.2.1.2 Family or assisted-use toilet rooms. Family or assisted-use toilet rooms shall include only one water closet and only one lavatory. A family or assisted-use bathing room in accordance with Section 1110.2.1.3 shall be considered to be a family or assisted-use toilet room.

Exception: The following additional fixtures shall be permitted in a family or assisted-use toilet room:

1. A urinal.
2. A child-height water closet.
3. A child-height lavatory.

1110.2.1.3 Family or assisted-use bathing rooms. Family or assisted-use bathing rooms shall include only one shower or bathtub fixture. Family or assisted-use bathing rooms shall also include one water closet and one lavatory. Where storage facilities are provided for separate-sex bathing rooms, accessible storage facilities shall be provided for family or assisted-use bathing rooms.

1110.2.1.4 Location. Family or assisted-use toilet and bathing rooms shall be located on an *accessible route*. Family or assisted-use toilet rooms shall be located not more than one *story* above or below separate-sex toilet rooms. The *accessible route* from any separate-sex toilet room to a family or assisted-use toilet room shall not exceed 500 feet (152 m).

1110.2.1.5 Prohibited location. In passenger transportation facilities and airports, the *accessible route* from separate-sex toilet rooms to a family or assisted-use toilet room shall not pass through security checkpoints.

1110.2.1.6 Privacy. Doors to family or assisted-use toilet and bathing rooms shall be securable from within the room and be provided with an "occupied" indicator.

1110.2.2 Water closets designed for assisted toileting. Water closets designed for assisted toileting shall comply with Sections 1110.2.2.1 through 1110.2.2.6.

1110.2.2.1 Location. The centerline of the water closet shall be not less than 24 inches (610 mm) and not greater than 26 inches (660 mm) from one side of the required clearance.

1110.2.2.2 Clearance. Clearance around the water closet shall comply with Sections 1110.2.2.2.1 through 1110.2.2.2.3.

1110.2.2.2.1 Clearance width. Clearance around a water closet shall be not less than 66 inches (1675 mm) in width, measured perpendicularly from the side of the clearance that is not less than 24 inches (610 mm) and not greater than 26 inches (660 mm) from the water closet centerline.

1110.2.2.2.2 Clearance depth. Clearance around the water closet shall be not less than 78 inches (1980 mm) in depth, measured perpendicularly from the rear wall

1110.2.3.9 Water temperature. Water temperature shall comply with ICC A117.1, Section 608.8.

1110.2.4 Water closet compartment. Where water closet compartments are provided in a toilet room or bathing room, at least 5 percent of the total number of compartments shall be wheelchair accessible. Where the combined total water closet compartments and urinals provided in a toilet room or bathing room is six or more, at least 5 percent of the total number of compartments shall be ambulatory accessible, provided in addition to the wheelchair-accessible compartment.

1110.2.5 Lavatories. Where lavatories are provided, at least 5 percent, but not less than one, shall be *accessible*. Where an accessible lavatory is located within the accessible water closet compartment at least one additional accessible lavatory shall be provided in the multicompartment toilet room outside the water closet compartment. Where the total lavatories provided in a toilet room or bathing facility is six or more, at least one lavatory with enhanced reach ranges shall be provided.

[S] 1110.2.6 Portable toilets and bathing rooms. Where multiple single-user portable toilet or bathing units are clustered at a single location, at least 5 percent, but not less than one toilet unit or bathing unit at each cluster, shall be accessible. Signs containing the International Symbol of Accessibility shall identify *accessible* portable toilets and bathing units.

Exception: Portable toilet units provided for use exclusively by construction personnel on a construction site.

1110.3 Sinks. Where sinks are provided, at least 5 percent but not less than one provided in accessible spaces shall be *accessible*.

Exception: Mop or service sinks are not required to be *accessible*.

1110.4 Kitchens and kitchenettes. Where kitchens and kitchenettes are provided in accessible spaces or rooms, they shall be *accessible*.

1110.5 Drinking fountains. Where drinking fountains are provided on an exterior site, on a floor or within a secured area, the drinking fountains shall be provided in accordance with Sections 1110.5.1 and 1110.5.2.

[W] 1110.5.1 Minimum number. Not fewer than two drinking fountains shall be provided. One drinking fountain shall comply with the requirements for people who use a wheelchair and one drinking fountain shall comply with the requirements for standing persons.

Exceptions:

1. A single drinking fountain with two separate spouts that complies with the requirements for people who use a wheelchair and standing persons shall be permitted to be substituted for two separate drinking fountains.
2. Where drinking fountains are primarily for children's use, drinking fountains for people using wheelchairs shall be permitted to comply with the children's provisions in ICC A117.1 and drinking fountains for standing children shall be permitted to provide the spout at 30 inches (762 mm) minimum above the floor.
3. In all occupancies that require more than two drinking fountains per floor or secured area, bottle filling stations shall be allowed to be substituted in accordance with Section 2902.5.4.

1110.5.2 More than the minimum number. Where more than the minimum number of drinking fountains specified in Section 1110.5.1 is provided, 50 percent of the total number of drinking fountains provided shall comply with the requirements for persons who use a wheelchair and 50 percent of the total number of drinking fountains provided shall comply with the requirements for standing persons.

Exceptions:

1. Where 50 percent of the drinking fountains yields a fraction, 50 percent shall be permitted to be rounded up or down, provided that the total number of drinking fountains complying with this section equals 100 percent of the drinking fountains.
2. Where drinking fountains are primarily for children's use, drinking fountains for people using wheelchairs shall be permitted to comply with the children's provisions in ICC A117.1 and drinking fountains for standing children shall be permitted to provide the spout at 30 inches (762 mm) minimum above the floor.

1110.6 Bottle-filling stations. Where bottle-filling stations are provided, they shall be *accessible*.

Exception: Bottle-filling stations over drinking fountains for standing persons are not required to be accessible, provided that bottle-filling stations are also located over the drinking fountains for persons using wheelchairs.

1110.7 Saunas and steam rooms. Where provided, saunas and steam rooms shall be *accessible*.

Exception: Where saunas or steam rooms are clustered at a single location, at least 5 percent of the saunas and steam rooms, but not less than one, of each type in each cluster shall be *accessible*.

1110.8 Elevators. Passenger elevators on an *accessible route* shall be *accessible* and comply with Chapter 30.

1110.9 Lifts. Platform (wheelchair) lifts are permitted to be a part of a required *accessible route* in new construction where indicated in Items 1 through 10. Platform (wheelchair) lifts shall be installed in accordance with ASME A18.1.

TABLE 1110.13.1
ACCESSIBLE CHECK-OUT AISLES

TOTAL CHECK-OUT AISLES OF EACH FUNCTION	MINIMUM NUMBER OF ACCESSIBLE CHECK-OUT AISLES OF EACH FUNCTION
1 to 4	1
5 to 8	2
9 to 15	3
Over 15	3, plus 20% of additional aisles

1110.13.2 Sales and service counters and windows. Where counters or windows are provided for sale or distribution of goods or services, at least one of each type of counter and window provided shall be *accessible*. Where such counters or windows are dispersed throughout the building or facility, accessible counters or windows shall also be dispersed.

1110.13.3 Food service lines. Food service lines shall be *accessible*. Where self-service shelves are provided, at least 50 percent, but not less than one, of each type provided shall be *accessible*.

1110.13.4 Queue and waiting lines. Queue and waiting lines servicing accessible counters or check-out aisles shall be *accessible*. **

1110.14 Dressing, fitting and locker rooms. Where dressing rooms, fitting rooms or locker rooms are provided, at least 5 percent, but not less than one, of each type of use in each cluster provided shall be *accessible*.

1110.15 Controls, operating mechanisms and hardware. Controls, operating mechanisms and hardware intended for operation by the occupant, including switches that control lighting and ventilation and electrical convenience outlets, in accessible spaces, along accessible routes or as parts of *accessible* elements shall be *accessible*.

Exceptions:

1. Operable parts that are intended for use only by service or maintenance personnel shall not be required to be *accessible.*
2. Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to comply with Section 1010.2.3.
3. Operable parts exempted in accordance with ICC A117.1 are not required to be accessible.

[W] 1110.16 Gaming machines, ((~~and gaming tables~~)) depositories, vending machines, change machines and similar equipment. ((~~At least two percent of the total, but not fewer than one, of each *gaming machine type* and *gaming table type* shall be *accessible*. Where multiple *gaming areas* occur, accessible gaming machines and gaming tables shall be distributed throughout.~~)) Not fewer than one of each type of depository, vending machine, change machine and similar equipment shall be *accessible*. Two percent of gaming machines shall be *accessible* and provided with a front approach. *Accessible* gaming machines shall be distributed throughout the different types of gaming machines provided. *

Exception: Drive-up-only depositories are not required to comply with this section.

[W] 1110.17 Laundry equipment. Where provided in spaces required to be *accessible*, washing machines and clothes dryers shall comply with this section.

1110.17.1 Washing machines. Where three or fewer washing machines are provided, at least one shall be accessible. Where more than three washing machines are provided, at least two shall be accessible.

1110.17.2 Clothes dryers. Where three or fewer clothes dryers are provided, at least one shall be accessible. Where more than three clothes dryers are provided, at least two shall be accessible.

[W] 1110.18 Mailboxes. Where *mailboxes* are provided in an interior location, at least 5 percent, but not less than one, of each type shall be accessible. In residential and institutional facilities, where *mailboxes* are provided for each *dwelling unit* or *sleeping unit*, accessible *mailboxes* shall be provided for each unit required to be an *accessible unit*.

[W] 1110.19 Automatic teller machines and fare machines. Where automatic teller machines or self-service fare vending, collection or adjustment machines are provided, at least one machine of each type at each location where such machines are provided shall be *accessible*. Where bins are provided for envelopes, wastepaper or other purposes, at least one of each type shall be accessible.

[W] 1110.20 Two-way communication systems. Where two-way communication systems are provided to gain admittance to a building or facility or to restricted areas within a building or facility, the system shall be accessible.

SECTION 1111
RECREATIONAL FACILITIES

1111.1 General. Recreational facilities shall be provided with accessible features in accordance with Sections 1111.2 through 1111.4.

[W] 1111.2 Facilities serving Group R-2, R-3 and R-4 occupancies. Recreational facilities that serve Group R-2, R-3 and Group R-4 occupancies shall comply with Sections 1111.2.1 through 1111.2.3, as applicable.

1111.2.1 Facilities serving Accessible units. In Group R-2 and R-4 occupancies where recreational facilities serve *Accessible units*, every recreational facility of each type serving *Accessible units* shall be *accessible*.

1111.2.2 Facilities serving Type A and Type B units in a single building. In Group R-2, R-3 and R-4 occupancies where recreational facilities serve a single building containing *Type A units* or *Type B units*, 25 percent, but not less than one, of each type of recreational facility shall be *accessible*. Every recreational facility of each type on a site shall be considered to determine the total number of each type that is required to be *accessible*.

1111.2.3 Facilities serving Type A and Type B units in multiple buildings. In Group R-2, R-3 and R-4 occupancies on a single site where multiple buildings containing *Type A units* or *Type B units* are served by recreational facilities, 25 percent, but not less than one, of each type of recreational facility serving each building shall be *accessible*. The total number of each type of recreational facility that is required to be *accessible* shall be determined by considering every recreational facility of each type serving each building on the site.

1111.3 Other occupancies. Recreational facilities not falling within the purview of Section 1111.2 shall be *accessible*.

1111.4 Recreational facilities. Recreational facilities shall be *accessible* and shall be on an *accessible route* to the extent specified in this section.

1111.4.1 Area of sport activity. Each *area of sport activity* shall be on an *accessible route* and shall not be required to be *accessible* except as provided for in Sections 1111.4.2 through 1111.4.15.

1111.4.2 Team or player seating. At least one wheelchair space shall be provided in team or player seating areas serving *areas of sport activity*.

Exception: Wheelchair spaces shall not be required in team or player seating areas serving bowling lanes that are not required to be *accessible* in accordance with Section 1111.4.3.

1111.4.3 Bowling lanes. An *accessible route* shall be provided to at least 5 percent, but not less than one, of each type of bowling lane.

1111.4.4 Court sports. In court sports, at least one *accessible route* shall directly connect both sides of the court.

1111.4.5 Raised boxing or wrestling rings. Raised boxing or wrestling rings are not required to be *accessible* or to be on an *accessible route*.

1111.4.6 Raised refereeing, judging and scoring areas. Raised structures used solely for refereeing, judging or scoring a sport are not required to be *accessible* or to be on an *accessible route*.

1111.4.7 Animal containment areas. Animal containment areas that are not within public use areas are not required to be *accessible* or to be on an *accessible route*.

1111.4.8 Amusement rides. Amusement rides that move persons through a fixed course within a defined area shall comply with Sections 1111.4.8.1 through 1111.4.8.3.

Exception: Mobile or portable amusement rides shall not be required to be *accessible*.

1111.4.8.1 Load and unload areas. Load and unload areas serving amusement rides shall be *accessible* and be on an *accessible route*. Where load and unload areas have more than one loading or unloading position, at least one loading and unloading position shall be on an *accessible route*.

1111.4.8.2 Wheelchair spaces, ride seats designed for transfer and transfer devices. Where amusement rides are in the load and unload position, the following shall be on an *accessible route*.

1. The position serving a wheelchair space.
2. Amusement ride seats designed for transfer.
3. Transfer devices.

1111.4.8.3 Minimum number. Amusement rides shall provide at least one wheelchair space, amusement ride seat designed for transfer or transfer device.

Exceptions:

1. Amusement rides that are controlled or operated by the rider are not required to comply with this section.

Exceptions:

1. Catch pools or a designated section of a pool used as a terminus for a water slide flume shall not be required to provide an *accessible* means of entry, provided that a portion of the catch pool edge is on an *accessible route*.
2. Where spas, cold baths or hot tubs are provided in a cluster, at least 5 percent, but not less than one of each type of spa, cold bath or hot tub in each cluster, shall be accessible and be on an *accessible route*.
3. *Swimming pools*, wading pools, spas, cold baths and hot tubs that are required to be *accessible* by Sections 1111.2.2 and 1111.2.3 are not required to provide *accessible* means of entry into the water.

1111.4.14.1 Raised diving boards and diving platforms. Raised diving boards and diving platforms are not required to be *accessible* or to be on an *accessible route*.

1111.4.14.2 Water slides. Water slides are not required to be *accessible* or to be on an *accessible route*.

1111.4.15 Shooting facilities with firing positions. Where shooting facilities with firing positions are designed and constructed at a site, at least 5 percent, but not less than one, of each type of firing position shall be *accessible* and be on an *accessible route*.

Exception: Shooting facilities with firing positions on free-standing platforms that are elevated more than 12 feet (3660 mm) above grade, provided that the aggregate area of the elevated firing positions is not more than 500 square feet (46 m^2), are not required to be accessible.

SECTION 1112
SIGNAGE

[W] 1112.1 Signs. Required accessible elements shall be identified by the International Symbol of Accessibility at the following locations.

1. Accessible parking spaces required by Section 1106.2.

   Exception: Where the total number of parking spaces provided is four or less, identification of accessible parking spaces is not required.

2. *Accessible* parking spaces required by Section 1106.3.

   Exception: In Group I-1, R-2, R-3 and R-4 facilities, where parking spaces are assigned to specific *dwelling units* or *sleeping units*, identification of *accessible* parking spaces is not required.

3. *Accessible* passenger loading zones.
4. *Accessible* toilet or bathing rooms where not all toilet or bathing rooms are *accessible*.
5. *Accessible* entrances where not all entrances are *accessible*.
6. *Accessible* check-out aisles where not all aisles are *accessible*. The sign, where provided, shall be above the check-out aisle in the same location as the checkout aisle number or type of check-out identification.
7. *Accessible* dressing, fitting and locker rooms where not all such rooms are *accessible*.
8. *Accessible areas of refuge* in accordance with Section 1009.9.
9. Exterior areas for assisted rescue in accordance with Section 1009.9.
10. In recreational facilities, lockers that are required to be *accessible* in accordance with Section 1110.10.

1112.2 Signs identifying toilet or bathing rooms. Signs required in Section 403.4 of the *International Plumbing Code* identifying toilet rooms and bathing rooms shall be visual characters, raised characters and braille complying with ICC A117.1. Where pictograms are provided as designations for toilet rooms and bathing rooms, the pictograms shall have visual characters, raised characters and braille complying with ICC A117.1.

1112.3 Directional signage. Directional signage indicating the route to the nearest like accessible element shall be provided at the following locations. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

1. Inaccessible building entrances.
2. Inaccessible public toilets and bathing facilities.
3. Elevators not serving an accessible route.
4. At each separate-sex toilet and bathing room indicating the location of the nearest family/assisted use toilet or bathing room where provided in accordance with Section 1110.2.1.
5. At *exits* and *exit stairways* serving a required *accessible* space, but not providing an *approved* accessible means of egress, signage shall be provided in accordance with Section 1009.10.

6. Where drinking fountains for persons using wheelchairs and drinking fountains for standing persons are not located adjacent to each other, directional signage shall be provided indicating the location of the other drinking fountains.

[S] 1112.4 Other signs. Signage indicating special accessibility provisions shall be provided as shown.

1. Each assembly area required to comply with Section 1109.2.7 shall provide a sign notifying patrons of the availability of assistive listening systems. The sign shall comply with ICC A117.1 requirements for visual characters and include the International Symbol of Access for Hearing Loss.

   Exception: Where ticket offices or windows are provided, signs are not required at each assembly area provided that signs are displayed at each ticket office or window informing patrons of the availability of assistive listening systems.
2. At each door to an *area of refuge* providing *direct access* to a *stairway*, exterior area for assisted rescue, exit *stairway, exit passageway* or *exit discharge*, signage shall be provided in accordance with Section 1013.4.
3. At *areas of refuge*, signage shall be provided in accordance with Section 1009.11.
4. At exterior areas for assisted rescue, signage shall be provided in accordance with Section 1009.11.
5. At two-way communication systems, signage shall be provided in accordance with Section 1009.8.2.
6. In *interior exit stairways* and *ramps*, floor level signage shall be provided in accordance with Section 1023.9.
7. Signs identifying the type of access provided on amusement rides required to be *accessible* by Section 1111.4.8 shall be provided at entries to queues and waiting lines. In addition, where accessible unload areas also serve as accessible load areas, signs indicating the location of the accessible load and unload areas shall be provided at entries to queues and waiting lines. These directional sign characters shall meet the visual character requirements in accordance with ICC A117.1.
8. At bus stops and terminals, signage shall be provided in accordance with Section 1114.4.
9. At fixed facilities and stations, signage shall be provided in accordance with Sections 1115.2.2 through 1115.2.2.3.
10. At airports, terminal information systems shall be provided in accordance with Section 1116.3.

1112.5 Variable message signs. Where provided in the locations in Sections 1112.5.1 and 1112.5.2, variable message signs shall comply with the variable message sign requirements of ICC A117.1.

1112.5.1 Transportation facilities. Where provided in transportation facilities, variable message signs conveying transportation-related information shall comply with Section 1112.5.

1112.5.2 Emergency shelters. Where provided in buildings that are designated as emergency shelters, variable message signs conveying emergency-related information shall comply with Section 1112.5.

Exception: Where equivalent information is provided in an audible manner, variable message signs are not required to comply with ICC A117.1.

[W] 1112.5 Designations. Interior and exterior signs identifying permanent rooms and spaces shall be visual characters, raised characters and braille complying with ICC A117.1. Where pictograms are provided as designations of interior rooms and spaces, the pictograms shall have visual characters, raised characters and braille complying with ICC A117.1.

Exceptions:

1. Exterior signs that are not located at the door to the space they serve are not required to comply.
2. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses and company names and logos are not required to comply.
3. Signs in parking facilities are not required to comply.
4. Temporary (seven days or less) signs are not required to comply.
5. In detention and correctional facilities, signs not located in public areas are not required to comply.

[W] 1112.6 Directional and informational signs. Signs that provide direction to, or information about, permanent interior spaces of the site and facilities shall contain visual characters complying with ICC A117.1.

Exception: Building directories, personnel names, company or occupant names and logos, menus and temporary (seven days or less) signs are not required to comply with ICC A117.1.

[W] SECTION 1113
TELEPHONES

1113.1 General. Where coin-operated public pay telephones, coinless public pay telephones, public *closed-circuit telephones*, courtesy phones or other types of public telephones are provided, *accessible* public telephones shall be provided in accordance

with Sections 1113.2 through 1113.5 for each type of public telephone provided. For purposes of this section, a bank of telephones shall be considered two or more adjacent telephones.

1113.2 Wheelchair-accessible telephones. Where public telephones are provided, *wheelchair-accessible* telephones shall be provided in accordance with Table 1113.2.

Exception: Drive-up-only public telephones are not required to be *accessible*.

TABLE 1113.2
WHEELCHAIR-ACCESSIBLE TELEPHONES

NUMBER OF TELEPHONES PROVIDED ON A FLOOR, LEVEL OR EXTERIOR SITE	MINIMUM REQUIRED NUMBER OF WHEELCHAIR-ACCESSIBLE TELEPHONES
1 or more single unit	1 per floor, level and exterior site
1 bank	1 per floor, level and exterior site
2 or more banks	1 per bank

1113.3 Volume controls. All public telephones provided shall have accessible volume control.

1113.4 TTYs. TTYs shall be provided in accordance with Sections 1113.4.1 through 1113.4.9.

1113.4.1 Bank requirement. Where four or more public pay telephones are provided at a bank of telephones, at least one public TTY shall be provided at that bank.

Exception: TTYs are not required at banks of telephones located within 200 feet (60 960 mm) of, and on the same floor as, a bank containing a public TTY.

1113.4.2 Floor requirement. Where four or more public pay telephones are provided on a floor of a privately owned building, at least one public TTY shall be provided on that floor. Where at least one public pay telephone is provided on a floor of a publicly owned building, at least one public TTY shall be provided on that floor.

1113.4.3 Building requirement. Where four or more public pay telephones are provided in a privately owned building, at least one public TTY shall be provided in the building. Where at least one public pay telephone is provided in a publicly owned building, at least one public TTY shall be provided in the building.

1113.4.4 Site requirement. Where four or more public pay telephones are provided on a site, at least one public TTY shall be provided on the site.

1113.4.5 Rest stops, emergency road stops, and service plazas. Where a public pay telephone is provided at a public rest stop, emergency road stop or service plaza, at least one public TTY shall be provided.

1113.4.6 Hospitals. Where a public pay telephone is provided in or adjacent to a hospital emergency room, hospital recovery room or hospital waiting room, at least one public TTY shall be provided at each such location.

1113.4.7 Transportation facilities. Transportation facilities shall be provided with TTYs in accordance with Sections 1115.2.5 and 1116.2 in addition to the TTYs required by Sections 1113.4.1 through 1113.4.4.

1113.4.8 Detention and correctional facilities. In detention and correctional facilities, where a public pay telephone is provided in a secured area used only by detainees or inmates and security personnel, then at least one TTY shall be provided in at least one secured area.

1113.4.9 Signs. Public TTYs shall be identified by the International Symbol of TTY complying with ICC A117.1. Directional signs indicating the location of the nearest public TTY shall be provided at banks of public pay telephones not containing a public TTY. Additionally, where signs provide direction to public pay telephones, they shall also provide direction to public TTYs. Such signs shall comply with visual signage requirements in ICC A117.1 and shall include the International Symbol of TTY.

1113.5 Shelves for portable TTYs. Where a bank of telephones in the interior of a building consists of three or more public pay telephones, at least one public pay telephone at the bank shall be provided with a shelf and an electrical outlet.

Exceptions:

1. In secured areas of detention and correctional facilities, if shelves and outlets are prohibited for purposes of security or safety shelves and outlets for TTYs are not required to be provided.
2. The shelf and electrical outlet shall not be required at a bank of telephones with a TTY.

[W] SECTION 1114
BUS STOPS

1114.1 General. Bus stops shall comply with Sections 1114.2 through 1114.5.

1114.2 Bus boarding and alighting areas. Bus boarding and alighting areas shall comply with Sections 1114.2.1 through 1114.2.4.

1114.2.1 Surface. Bus boarding and alighting areas shall have a firm, stable surface.

1114.2.2 Dimensions. Bus boarding and alighting areas shall have a clear length of 96 inches (2440 mm) minimum, measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60 inches (1525 mm) minimum, measured parallel to the vehicle roadway.

1114.2.3 Connection. Bus boarding and alighting areas shall be connected to streets, sidewalks or pedestrian paths by an *accessible route* complying with Section 1104.

1114.2.4 Slope. Parallel to the roadway, the slope of the bus boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. For water drainage, a maximum slope of 1:48 perpendicular to the roadway is allowed.

1114.3 Bus shelters. Where provided, new or replaced bus shelters shall provide a minimum clear floor or ground space complying with ICC A117.1, Section 305, entirely within the shelter. Such shelters shall be connected by an *accessible route* to the boarding area required by Section 1114.2.

1114.4 Signs. New bus route identification signs shall have finish and contrast complying with ICC A117.1. Additionally, to the maximum extent practicable, new bus route identification signs shall provide visual characters complying with ICC A117.1.

Exception: Bus schedules, timetables and maps that are posted at the bus stop or bus bay are not required to meet this requirement.

1114.5 Bus stop siting. Bus stop sites shall be chosen such that, to the maximum extent practicable, the areas where lifts or ramps are to be deployed comply with Sections 1114.2 and 1114.3.

[W] SECTION 1115
TRANSPORTATION FACILITIES AND STATIONS

1115.1 General. Fixed transportation facilities and stations shall comply with the applicable provisions of Section 1115.2.

1115.2 New construction. New stations in rapid rail, light rail, commuter rail, intercity rail, high speed rail and other fixed guideway systems shall comply with Sections 1115.2.1 through 1115.2.8.

1115.2.1 Station entrances. Where different entrances to a station serve different transportation fixed routes or groups of fixed routes, at least one entrance serving each group or route shall comply with Section 1104.

1115.2.2 Signs. Signage in fixed transportation facilities and stations shall comply with Sections 1115.2.2.1 through 1115.2.2.3.

1115.2.2.1 Raised character and braille signs. Where signs are provided at entrances to stations identifying the station or the entrance, or both, at least one sign at each entrance shall be raised characters and braille. A minimum of one raised character and braille sign identifying the specific station shall be provided on each platform or boarding area. Such signs shall be placed in uniform locations at entrances and on platforms or boarding areas within the transit system to the maximum extent practicable.

Exceptions:

1. Where the station has no defined entrance but signs are provided, the raised characters and braille signs shall be placed in a central location.
2. Signs are not required to be raised characters and braille where audible signs are remotely transmitted to hand-held receivers, or are user or proximity actuated.

1115.2.2.2 Identification signs. Stations covered by this section shall have identification signs containing visual characters complying with ICC A117.1. Signs shall be clearly visible and within the sightlines of a standing or sitting passenger from within the train on both sides when not obstructed by another train.

1115.2.2.3 Informational signs. Lists of stations, routes and destinations served by the station which are located on boarding areas, platforms or mezzanines shall provide visual characters complying with ICC A117.1 Signs covered by this provision shall, to the maximum extent practicable, be placed in uniform locations within the transit system.

1115.2.3 Fare machines. Self-service fare vending, collection and adjustment machines shall comply with ICC A117.1, Section 707. Where self-service fare vending, collection or adjustment machines are provided for the use of the general public, at least one accessible machine of each type provided shall be provided at each accessible point of entry and exit.

1115.2.4 Rail-to-platform height. Station platforms shall be positioned to coordinate with vehicles in accordance with the applicable provisions of 36 CFR, Part 1192. Low-level platforms shall be 8 inches (250 mm) minimum above top of rail.

Exception: Where vehicles are boarded from sidewalks or street level, low-level platforms shall be permitted to be less than 8 inches (250 mm).

1115.2.5 TTYs. Where a public pay telephone is provided in a transit facility (as defined by the Department of Transportation) at least one public TTY complying with ICC A117.1, Section 704.4, shall be provided in the station. In addition, where one or more public pay telephones serve a particular entrance to a transportation facility, at least one TTY telephone complying with ICC A117.1, Section 704.4, shall be provided to serve that entrance.

1115.2.6 Track crossings. Where a *circulation path* serving boarding platforms crosses tracks, an *accessible route* shall be provided.

Exception: Openings for wheel flanges shall be permitted to be 2-1/2 inches (64 mm) maximum.

1115.2.7 Public address systems. Where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

1115.2.8 Clocks. Where clocks are provided for use by the general public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals and digits shall contrast with the background either light-on-dark or dark-on-light. Where clocks are mounted overhead, numerals and digits shall comply with visual character requirements.

[W] SECTION 1116
AIRPORTS

1116.1 New construction. New construction of airports shall comply with Sections 1116.2 through 1116.4.

1116.2 TTYs. Where public pay telephones are provided, at least one TTY shall be provided in compliance with ICC A117.1, Section 704.4. Additionally, if four or more public pay telephones are located in a main terminal outside the security areas, a concourse within the security areas or a baggage claim area in a terminal, at least one public TTY complying with ICC A117.1, Section 704.4, shall also be provided in each such location.

1116.3 Terminal information systems. Where terminal information systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

1116.4 Clocks. Where clocks are provided for use by the general public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals and digits shall contrast with the background either light-on-dark or dark-on-light. Where clocks are mounted overhead, numerals and digits shall comply with visual character requirements.

CHAPTER 12

INTERIOR ENVIRONMENT

User note:

About this chapter: *Chapter 12 provides minimum provisions for the interior of buildings—the occupied environment. Ventilation, lighting, and space heating are directly regulated in this chapter and in conjunction with the* International Mechanical Code® *and the* International Energy Conservation Code®. *Minimum room size, maximum room-to-room sound transmission and classroom acoustics are set for educational occupancies.*

SECTION 1201
GENERAL

1201.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, *yards* and *courts*, sound transmission, room dimensions, surrounding materials and rodentproofing associated with the interior spaces of buildings.

SECTION 1202
VENTILATION

[W] 1202.1 General. Buildings shall be provided with natural ventilation in accordance with Section 1202.5, or mechanical ventilation in accordance with the *International Mechanical Code*.

((~~Where the air infiltration rate in a *dwelling unit* is less than 5 air changes per hour where tested with a blower door at a pressure 0.2 inch w.c. (50 Pa) in accordance with Section R402.4.1.2 of the *International Energy Conservation Code—Residential Provisions*, the *dwelling unit* shall be ventilated by mechanical means in accordance with Section 403 of the *International Mechanical Code*.~~)) *Ambulatory care facilities* and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407 of the *International Mechanical Code*.

1202.2 Roof ventilation. Roof assemblies shall be ventilated in accordance with this section or shall comply with Section 1202.3.

[S] 1202.2.1 ((~~Ventilated atties and rafter~~)) Attic spaces. Enclosed *attics* and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. An airspace of not less than 1 inch (25 mm) shall be provided between the insulation and the roof sheathing. The net free ventilating area shall be not less than 1/150 of the area of the space ventilated. Ventilators shall be installed in accordance with manufacturer's installation instructions.

Exception: The net free cross-ventilation area shall be permitted to be reduced to 1/300 ((~~provided both of the following conditions are met:~~

~~1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.~~

~~2. At~~)) if at least 40 percent and not more than 50 percent of the required venting area is provided by ventilators located in the upper portion of the *attic* or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the *ventilation* provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

1202.2.2 Openings into attic. Exterior openings into the *attic* space of any building intended for human occupancy shall be protected to prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. Openings for ventilation having a least dimension of not less than 1/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm) shall be permitted. Openings for ventilation having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of not less than 1/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm). Where combustion air is obtained from an *attic* area, it shall be in accordance with Chapter 7 of the *International Mechanical Code*.

[S] 1202.3 Unvented attic and unvented enclosed rafter assemblies. Unvented *attics* and unvented enclosed roof framing assemblies created by ceilings applied directly to the underside of the roof framing members/rafters and the structural roof sheathing at the top of the roof framing members shall be permitted where all of the following conditions are met:

1. The unvented *attic* space is completely within the *building thermal envelope*.

2. No interior Class I vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, not less than a 1/4-inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing *underlayment* above the structural sheathing.

((~~4. In Climate Zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a Class II vapor retarder or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.~~

~~5~~)) 4. Insulation shall comply with either Item ((~~5.1 or 5.2~~)) 4.1, and additionally Item ((~~5.3~~)) 4.3.

((~~5.1~~)) 4.1. Item ((~~5.1.1, 5.1.2, 5.1.3 or 5.1.4~~)) 4.1.1, 4.1.2, 4.1.3 or 4.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

((~~5.1.1~~)) 4.1.1. Where only *air-impermeable insulation* is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.

((~~5.1.2~~)) 4.1.2. Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed in accordance with Item ((~~5.1.1~~)) 4.1.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing ((~~in accordance with the *R*-values in Table 1202.3 for condensation control~~)) and shall have a minimum R-value of 10.

((~~5.1.3~~)) 4.1.3. Where both air-impermeable and air-permeable insulation are provided, the *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item ((~~5.1.1~~)) 4.1.1 and shall ((~~be in accordance with the *R*-values in Table 1202.3 for condensation control~~)) have a minimum R-value of 10. The *air-permeable insulation* shall be installed directly under the *air-impermeable insulation*.

((~~5.1.4~~)) 4.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

((~~5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented attics shall meet the following requirements:~~

~~5.2.1. A vapor diffusion port shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.~~

~~5.2.2. The port area shall be greater than or equal to 1/600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.~~

~~5.2.3. The vapor permeable membrane in the vapor diffusion port shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.~~

~~5.2.4. The vapor diffusion port shall serve as an air barrier between the attic and the exterior of the building.~~

~~5.2.5. The vapor diffusion port shall protect the attic against the entrance of rain and snow.~~

~~5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (50 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.~~

~~5.2.7. The roof slope shall be greater than or equal to 3 units vertical in 12 units horizontal (3:12).~~

~~5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top the attic floor, or on top of the ceiling.~~

~~5.2.9. Where only air-permeable insulation is used and is installed directly below the structural roof sheathing, air shall be supplied at a flow rate greater than or equal to 50 cubic feet per minute (23.6 L/s) per 1,000 square feet (93 m^2) of ceiling.~~

~~5.3~~)) 4.2. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

((~~Exceptions~~)) Exception: ((~~1.~~)) Section 1202.3 does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals or art galleries.

((~~2. Section 1202.3 does not apply to enclosures in Climate Zones 5 through 8 that are humidified beyond 35 percent during the three coldest months.~~))

[S] ((~~TABLE 1202.3~~
~~INSULATION FOR CONDENSATION CONTROL~~

~~CLIMATE ZONE~~	~~MINIMUM *R* VALUE OF AIR-IMPERMEABLE INSULATION[a]~~
~~2B and 3B tile roof only~~	~~0 (none required)~~
~~1, 2A, 2B, 3A, 3B, 3C~~	~~R-5~~
~~4C~~	~~R-10~~
~~4A, 4B~~	~~R-15~~
~~5~~	~~R-20~~
~~6~~	~~R-25~~
~~7~~	~~R-30~~
~~8~~	~~R-35~~

a. ~~Contributes to, but does not supersede, thermal resistance requirements for attic and roof assemblies in Section C402.2.1 of the *International Energy Conservation Code*.~~))

[W] 1202.4 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any building except spaces occupied by basements or cellars shall be provided with ventilation in accordance with Section 1202.4.1, 1202.4.2 or 1202.4.3. A ground cover of six mil (0.006 inch thick) black polyethylene or *approved* equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped six inches minimum at the joints and shall extend to the foundation wall.

Exception: The ground cover may be omitted in crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of two inches.

1202.4.1 Ventilation openings. Ventilation openings through foundation walls shall be provided. The openings shall be placed so as to provide cross ventilation of the under-floor space. The net area of ventilation openings shall be in accordance with Section 1202.4.1.1 or 1202.4.1.2. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall be not greater than 1/4 inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grilles or gratings.
4. Extruded load-bearing vents.
5. Hardware cloth of 0.035-inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension not greater than 1/8 inch (3.2 mm).
7. Operable louvres, where ventilation is provided in accordance with Section 1202.4.1.2.

1202.4.1.1 Ventilation area for crawl spaces with open earth floors. The net area of ventilation openings for crawl spaces with uncovered earth floors shall be not less than 1 square foot for each 150 square feet (0.67 m^2 for each 100 m^2) of crawl space area.

1202.4.1.2 Ventilation area for crawl spaces with covered floors. The net area of ventilation openings for crawl spaces with the ground surface covered with a Class I vapor retarder shall be not less than 1 square foot for each 1,500 square feet (0.67 m^2 for each 1000 m^2) of crawl space area.

1202.4.2 Ventilation in cold climates. In extremely cold climates, where a ventilation opening will cause a detrimental loss of energy, ventilation openings to the interior of the structure shall be provided.

1202.4.3 Mechanical ventilation. Mechanical ventilation shall be provided to crawl spaces where the ground surface is covered with a Class I vapor retarder. Ventilation shall be in accordance with Section 1202.4.3.1 or 1202.4.3.2.

1202.4.3.1 Continuous mechanical ventilation. Continuously operated mechanical ventilation shall be provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 square feet (1.02 L/s for each 10 m^2) of crawl space ground surface area and the ground surface shall be covered with a Class I vapor retarder.

1202.4.3.2 Conditioned space. The crawl space shall be conditioned in accordance with the *International Mechanical Code* and the walls of the crawl space shall be insulated in accordance with the *International Energy Conservation Code*.

1202.4.4 Flood hazard areas. For buildings in *flood hazard areas* as established in Section 1612.3, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.

[W][S] 1202.5 Natural ventilation. ((~~Natural~~)) Where provided in other than Group R occupancies, natural *ventilation* of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such

openings shall be provided with ready access so that the openings are readily controllable by the building occupants. Group R occupancies shall comply with the *International Mechanical Code*.

1202.5.1 Ventilation area required. The openable area of the openings to the outdoors shall be not less than 4 percent of the floor area being ventilated.

1202.5.1.1 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m^2). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for *ventilation* shall be allowed to open into a *sunroom* with *thermal isolation* or a patio cover provided that the openable area between the *sunroom* addition or patio cover and the interior room shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m^2). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

1202.5.1.2 Openings below grade. Where openings below grade provide required natural *ventilation*, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

1202.5.2 Contaminants exhausted. Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *International Mechanical Code* and the *International Fire Code*.

1202.5.2.1 Bathrooms. Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the *International Mechanical Code*.

1202.5.3 Openings on yards or courts. Where natural *ventilation* is to be provided by openings onto *yards* or *courts*, such *yards* or *courts* shall comply with Section 1205.

1202.6 Other ventilation and exhaust systems. *Ventilation* and exhaust systems for occupancies and operations involving flammable or combustible hazards or other contaminant sources as covered in the *International Mechanical Code* or the *International Fire Code* shall be provided as required by both codes.

[W] 1202.7 Crawlspace ventilation. All crawlspaces shall be ventilated as specified in Section 1202.4. If the installed ventilation in a crawlspace is less than one square foot for each 300 square feet of crawlspace area, or if the crawlspace vents are equipped with operable louvers, a radon vent shall be installed to originate from a point between the ground cover and soil. The radon vent shall be installed in accordance with Sections 1202.7.2 through 1202.7.6.

1202.7.1 Crawlspace plenum systems. In crawlspace plenum systems used for providing supply air for an HVAC system, aggregate, a permanently sealed soil gas retarder membrane and a radon vent pipe shall be installed in accordance with Section 1202.7.2 through 1202.7.6. Crawlspaces shall not be used for return air plenums.

In addition, an operable radon vent fan shall be installed and activated. The fan shall be located as specified in Section 1202.7.6. The fan shall be capable of providing at least 100 cfm at 1-inch water column static pressure. The fan shall be controlled by a readily accessible manual switch. The switch shall be labeled "RADON VENT FAN."

1202.7.2 Aggregate. A layer of aggregate of 4-inch minimum thickness shall be placed beneath concrete slabs. The aggregate shall be continuous to the extent practical.

[S] 1202.7.2.1 Aggregate grade. Aggregate shall:

1. Comply with ASTM Standard C-33 Standard Specification for Concrete Aggregate and shall be size No. 8 or larger size aggregate as listed in Table 2, Grading Requirements for Coarse Aggregate; or
2. Meet the 1988 Washington State Department of Transportation Specification 9-03.1(3) "Coarse Aggregate for Portland Cement Concrete," or any equivalent successor standards. Aggregate size shall be of Grade 8 or larger as listed in Section 9-03.1(3)(C), "Grading"; or
3. Be screened, washed pea gravel free of deleterious substances in a manner consistent with ASTM Standard C-33 with 100 percent passing a 1/2-inch sieve and less than 5 percent passing a No. 16 sieve. Sieve characteristics shall conform to those acceptable under ASTM Standard C-33.

Exception: Aggregate shall not be required if a substitute material or system, with sufficient load-bearing characteristics, and having *approved* capability to provide equal or superior air flow, is installed.

1202.7.3 Soil-gas retarder membrane. A soil-gas retarder membrane, consisting of at least one layer of virgin polyethylene with a thickness of at least 6 mil, or equivalent flexible sheet material, shall be either placed directly under all concrete slabs so that the slab is in direct contact with the membrane, or on top of the aggregate with 2 inches minimum of fine sand or pea gravel installed between the concrete slab and membrane. The flexible sheet shall extend to the foundation wall or to the outside edge of the monolithic slab. Seams shall overlap at least 12 inches. The membrane shall also be fitted tightly to all pipes, wires, and other penetrations of the membrane and sealed with an *approved* sealant or tape. All punctures or tears shall be repaired with the same or *approved* material and similarly lapped and sealed.

1202.7.4 Sealing of penetrations and joints. All penetrations and joints in concrete slabs or other floor systems and walls below grade shall be sealed by an *approved* sealant to create an air barrier to limit the movement of soil-gas into the indoor air.

Sealants shall be *approved* by the manufacturer for the intended purpose. Sealant joints shall conform to manufacturer's specifications. The sealant shall be placed and tooled in accordance with manufacturer's specifications. There shall be no gaps or voids after the sealant has cured.

1202.7.5 Radon vent. One continuous sealed pipe shall run from a point within the aggregate under each concrete slab to a point outside the building. Joints and connections shall be permanently gas tight. The continuous sealed pipe shall interface with the aggregate in the following manner, or by other *approved* equal method. The pipe shall be permanently connected to a "T" within the aggregate area so that the two end openings of the "T" lie within the aggregate area. A minimum of 5 feet of perforated drain pipe of 3 inches minimum diameter shall join to and extend from the "T." The perforated pipe shall remain in the aggregate area and shall not be capped at the ends. The "T" and its perforated pipe extensions shall be located at least 5 feet horizontally from the exterior perimeter of the aggregate area.

The continuous sealed pipe shall terminate no less than 12 inches above the eave, and more than 10 horizontal feet from a woodstove or fireplace chimney, or operable window. The continuous sealed pipe shall be labeled "radon vent." The label shall be placed so as to remain visible to an occupant.

The minimum pipe diameter shall be 3 inches unless otherwise *approved*. Acceptable sealed plastic pipe shall be smooth walled, and may include either PVC schedule 40 or ABS schedule of equivalent wall thickness.

The entire sealed pipe system shall be sloped to drain to the subslab aggregate.

The sealed pipe system may pass through an unconditioned *attic* before exiting the building; but to the extent practicable, the sealed pipe shall be located inside the thermal envelope of the building in order to enhance passive stack venting.

Exception: A fan for subslab depressurization system includes the following:

1. Soil-gas retarder membrane as specified in Section 1202.7.3;
2. Sealing of penetrations and joints as specified in Section 1202.7.4;
3. A 3-inch continuous sealed radon pipe shall run from a point within the aggregate under each concrete slab to a point outside the building;
4. Joints and connections shall be gas tight, and may be of either PVC schedule 40 or ABS schedule of equivalent wall thickness;
5. A label of "radon vent" shall be placed on the pipe so as to remain visible to an occupant;
6. Fan circuit and wiring as specified in Section 1202.7.6 and a fan.

If the subslab depressurization system is exhausted through the concrete foundation wall or rim joist, the exhaust terminus shall be a minimum of 6 feet from operable windows or outdoor air intake vents and shall be directed away from operable windows and outdoor air intake vents to prevent radon reentrainment.

1202.7.6 Fan circuit and wiring and location. An area for location of an in-line fan shall be provided. The location shall be as close as practicable to the radon vent pipe's point of exit from the building, or shall be outside the building shell; and shall be located so that the fan and all downstream piping is isolated from the indoor air. Provisions shall be made to allow future activation of an inline fan on the radon vent pipe without the need to place new wiring. A 110-volt power supply shall be provided at a junction box near the fan location.

1202.7.7 Separate aggregate areas. If the 4-inch aggregate area underneath the concrete slab is not continuous, but is separated into distinct isolated aggregate areas by a footing or other barrier, a minimum of one radon vent pipe shall be installed into each separate aggregate area.

Exception: Separate aggregate areas may be considered a single area if a minimum 3-inch diameter connection joining the separate areas is provided for every 30 feet of barrier separating those areas.

1202.7.8 Concrete block walls. Concrete block walls connected to below grade areas shall be considered unsealed surfaces. All openings in concrete block walls that will not remain accessible upon completion of the building shall be sealed at both vertical and horizontal surfaces, in order to create a continuous air barrier to limit the transport of soil-gas into the indoor air.

SECTION 1203
TEMPERATURE CONTROL

[W][S] 1203.1 Equipment and systems. Interior spaces intended for human occupancy shall be provided with active or passive space heating systems capable of maintaining an indoor temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor ((~~on the design heating day~~)) when the outside temperature is 24°F.

Exceptions: Space heating systems are not required for:

1. Interior spaces where the primary purpose of the space is not associated with human comfort.
2. Group F, H, S or U occupancies.
3. Group R-1 occupancies not more than 500 square feet (139 m^2) in area.

See the *International Energy Conservation Code* and *International Mechanical Code* for additional requirements for heating systems.

[W] 1203.2 Use of solid-fuel-burning devices.

1203.2.1 Definitions. For the purposes of this section only, the following definitions apply.

DESIGNATED AREAS. Those areas designated by a county to be an urban growth area in Chapter 36.70A RCW and those areas designated by the U.S. Environmental Protection Agency as being in nonattainment for particulate matter.

SUBSTANTIALLY REMODELED. Any alteration or restoration of a building exceeding 60 percent of the appraised value of such building within a 12-month period. For the purpose of this section, the appraised value is the estimated cost to replace the building and structure in kind, based on current replacement costs.

1203.2.2 Primary heating source. Primary heating sources in all new and substantially remodeled buildings in designated areas shall not be dependent upon wood stoves.

1203.2.3 Solid fuel burning devices. No new or used solid fuel burning device shall be installed in new or *existing buildings* unless such device is United States Environmental Protection Agency certified or exempt from certification by the United States Environmental Protection Agency and conforms with RCW 70.94.011, 70.94.450, 70.94.453 and 70.94.457.

Exceptions:

1. Wood cook stoves.
2. Antique wood heaters manufactured prior to 1940.

SECTION 1204
LIGHTING

1204.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with Section 1204.2 or shall be provided with artificial light in accordance with Section 1204.3. Exterior glazed openings shall open directly onto a *public way* or onto a *yard* or *court* in accordance with Section 1205.

1204.2 Natural light. The minimum net glazed area shall be not less than 8 percent of the floor area of the room served.

1204.2.1 Adjoining spaces. For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m^2), whichever is greater.

Exception: Openings required for natural light shall be permitted to open into a *sunroom* with *thermal isolation* or a patio cover where the common wall provides a glazed area of not less than one-tenth of the floor area of the interior room or 20 square feet (1.86 m^2), whichever is greater.

1204.2.2 Exterior openings. Exterior openings required by Section 1204.2 for natural light shall open directly onto a *public way*, *yard* or *court*, as set forth in Section 1205.

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch meets all of the following criteria:
   1.1. Abuts a *public way*, *yard* or *court*.
   1.2. Has a ceiling height of not less than 7 feet (2134 mm).
   1.3. Has a longer side at least 65 percent open and unobstructed.
2. Skylights are not required to open directly onto a *public way*, *yard* or *court*.

1204.3 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

[S] 1204.4 Stairway illumination. *Stairways* within *dwelling units* and *exterior stairways* serving a *dwelling unit* shall have an illumination level on tread runs of not less than 1 footcandle (11 lux). *Stairways* in other occupancies shall be governed by Chapter 10.

1204.4.1 Controls. The control for activation of the required *stairway* lighting shall be in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code* and the *International Energy Conservation Code*.

1204.5 Emergency egress lighting. The *means of egress* shall be illuminated in accordance with Section 1008.1.

SECTION 1205
YARDS OR COURTS

1205.1 General. This section shall apply to *yards* and *courts* adjacent to exterior openings that provide natural light or ventilation. Such *yards* and *courts* shall be on the same *lot* as the building.

1205.2 Yards. *Yards* shall be not less than 3 feet (914 mm) in width for buildings two *stories* or less above *grade plane*. For buildings more than two *stories above grade plane*, the minimum width of the *yard* shall be increased at the rate of 1 foot (305 mm) for each additional *story*. For buildings exceeding 14 *stories above grade plane*, the required width of the *yard* shall be computed on the basis of 14 *stories above grade plane*.

1205.3 Courts. *Courts* shall be not less than 3 feet (914 mm) in width. *Courts* having windows opening on opposite sides shall be not less than 6 feet (1829 mm) in width. *Courts* shall be not less than 10 feet (3048 mm) in length unless bounded on one end by a *public way* or *yard*. For buildings more than two *stories above grade plane*, the *court* shall be increased 1 foot (305 mm) in width and 2 feet (610 mm) in length for each additional *story*. For buildings exceeding 14 *stories above grade plane*, the required dimensions shall be computed on the basis of 14 *stories above grade plane*.

1205.3.1 Court access. Access shall be provided to the bottom of *courts* for cleaning purposes.

1205.3.2 Air intake. *Courts* more than two *stories* in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m^2) in area and leading to the exterior of the building unless abutting a *yard* or *public way*.

[S] 1205.3.3 Court drainage. The bottom of every *court* shall be properly graded and drained to a public sewer or other *approved* disposal system complying with the ((~~*International*~~)) *Uniform Plumbing Code*.

SECTION 1206
SOUND TRANSMISSION

1206.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent *dwelling units* and *sleeping units* or between *dwelling units* and *sleeping units* and adjacent public areas.

[S] 1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50 where tested in accordance with ASTM E90, or have a Normalized Noise Isolation Class (NNIC) rating of not less than 45 if field tested, in accordance with ASTM E336 for airborne noise. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. ((~~This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.~~))

Exception: *Dwelling unit* or guest room entrance doors from interior corridors and interconnecting doors between separate units shall have perimeter seals. Such door assemblies shall have a sound transmission class (STC) rating of not less than 28.

1206.2.1 Masonry. The sound transmission class of concrete masonry and clay masonry assemblies shall be calculated in accordance with TMS 302 or determined through testing in accordance with ASTM E90.

[S] 1206.3 Structure-borne sound. Floor-ceiling assemblies between *dwelling units* and *sleeping units* or between a *dwelling unit* or *sleeping unit* and a public or service area within the structure shall have an impact insulation class rating of not less than 50 where tested in accordance with ASTM E492, or have a Normalized Impact Sound Rating (NISR) of not less than 45 if field tested in accordance with ASTM E1007. Alternatively, the impact insulation class of floor-ceiling assemblies shall be established by engineering analysis based on a comparison of floor-ceiling assemblies having impact insulation class ratings as determined by the test procedures in ASTM E492.

Exception: Floor assemblies in the bathrooms of Group R-1 occupancies are not required to meet the impact insulation class of 50 where structural concrete floor systems are used.

Joints in the perimeter of the separating wall or floor-ceiling assemblies shall be acoustically sealed with a permanent resilient material *approved* for the purpose. The separating wall or floor-ceiling assembly shall extend completely to and be sealed to another separating assembly or an exterior wall, roof or floor assembly.

Conduits, ducts, pipes and vents within the wall or floor-ceiling assemblies causing vibration shall be reasonably isolated from the building construction at points of support by means of resilient sleeves, mounts or underlayments. All other openings

through which such conduits, ducts, pipes or vents pass shall have the excess opening fully sealed with insulative and permanently resilient materials *approved* for the purpose.

Electrical outlet boxes shall not be placed back-to-back and shall be offset by not less than 12 inches (305 mm) from outlets in the opposite wall surface. The back and sides of boxes shall be sealed with one-eighth-inch resilient sealant and backed by a minimum of 2-inch (51 mm) thick material fiber insulation or *approved* equivalent.

Metal ventilating and conditioned air ducts which pass between dwelling units shall be fabricated and installed to maintain required sound transmission ratings.

[S] 1206.4 Tested assemblies. Field- or laboratory-tested wall or floor-ceiling designs having an STC or IIC of 50 or more are permitted to be used without additional field testing when, in the opinion of the *building official*, the tested design has not been compromised by flanking paths. The *building official* is permitted to require tests when evidence of compromised separations is noted.

[S] 1206.5 Field testing and certification. Field testing, when permitted to determine airborne sound transmission or impact sound insulation class, shall be done in accordance with ASTM E 336 or ASTM E 492 under the supervision of an acoustical professional who is experienced in the field of acoustical testing and engineering and who shall forward certified test results to the building official that minimum sound insulation requirements stated above have been met.

[S] 1206.6 Mechanical equipment spaces. Spaces or shafts containing air conditioning, refrigeration or ventilating equipment, elevator machinery, or other mechanical equipment shall be separated both vertically and horizontally from adjoining dwelling units or guest rooms by construction designed to provide a minimum STC rating of 50.

[S] 1206.7 Sound transmission control systems. Generic systems as listed in GA 600 shall be accepted where a laboratory test indicates that the requirements of Section 1206 are met by the system.

Note: Design and materials for sound transmission control shall not impair the fire-resistive integrity of separating walls or floor-ceiling assemblies required to be of fire-resistive construction.

SECTION 1207
ENHANCED CLASSROOM ACOUSTICS

1207.1 General. Enhanced classroom acoustics, where required by this section, shall comply with Section 808 of ICC A117.1.

1207.2 Where required. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (566 m^3) or less.

SECTION 1208
INTERIOR SPACE DIMENSIONS

Interpretation I1208: The required habitable space and minimum dimensions shall not include built-in equipment such as wardrobes, cabinets, or fixtures.

1208.1 Minimum room widths. *Habitable* spaces, other than a kitchen, shall be not less than 7 feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet (914 mm) between counter fronts and appliances or counter fronts and walls.

[S] 1208.2 Minimum ceiling heights. *Occupiable spaces*, *habitable spaces* and corridors shall have a ceiling height of not less than 7 feet 6 inches (2286 mm) above the finished floor. Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall have a ceiling height of not less than 7 feet (2134 mm) above the finished floor.

Exceptions:

1. In one- and two-family *dwellings*, beams or girders spaced not less than 4 feet (1219 mm) on center shall be permitted to project not more than 6 inches (152 mm) below the required ceiling height.
2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than 5 feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof.
3. The height of *mezzanines* and spaces below *mezzanines* shall be in accordance with Section 505.2.
4. Corridors contained within a *dwelling unit* or *sleeping unit* in a Group R occupancy shall have a ceiling height of not less than 7 feet (2134 mm) above the finished floor.
5. Ceiling height in the means of egress shall comply with Section 1003.2.

Notwithstanding the exceptions to Section 1207.2, protruding objects in circulation routes in spaces required to be accessible shall comply with Chapter 11 and ANSI A117.1 Section 307.

1208.2.1 Furred ceiling. Any room with a furred ceiling shall be required to have the minimum ceiling height in two-thirds of the area thereof, but in no case shall the height of the furred ceiling be less than 7 feet (2134 mm).

[W][S] 1208.3 Dwelling unit size. *Dwelling units* shall have a minimum of 190 square feet (17.7 m^2) of *habitable space* or shall comply with rules promulgated by the building official.

[W] ((~~1208.3~~)) 1208.4 Room area. Every *dwelling unit* shall have not less than one room that shall have not less than 120 square feet (11.2 m^2) of *net floor area*. ((~~Other~~)) Sleeping units and habitable rooms of a dwelling unit shall have a *net floor area* of not less than 70 square feet (6.5 m^2).

Exception: Kitchens are not required to be of a minimum floor area.

[W] ((~~1208.4~~)) 1208.5 Efficiency dwelling units. *Efficiency dwelling units* shall conform to the requirements of the code except as modified herein:

1. The unit's ((~~shall have a living room of not less than 190 square feet (17.7 m^2) of floor area~~)) *habitable space* shall comply with Sections 1208.1 through 1208.4.
2. The unit shall be provided with a separate closet.
3. For other than *Accessible*, Type A and Type B dwelling units, the unit shall be provided with a kitchen sink, cooking appliance and refrigerator, each having a clear working space of not less than 30 inches (762 mm) in front. Light and *ventilation* conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

SECTION 1209
ACCESS TO UNOCCUPIED SPACES

1209.1 Crawl spaces. Crawl spaces shall be provided with not less than one access opening that shall be not less than 18 inches by 24 inches (457 mm by 610 mm).

1209.2 Attic spaces. An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any *attic* area having a clear height of over 30 inches (762 mm). Clear headroom of not less than 30 inches (762 mm) shall be provided in the *attic* space at or above the access opening.

1209.3 Mechanical appliances. Access to mechanical appliances installed in under-floor areas, in *attic* spaces and on roofs or elevated structures shall be in accordance with the *International Mechanical Code*.

SECTION 1210
TOILET AND BATHROOM REQUIREMENTS

[P] 1210.1 Required fixtures. The number and type of plumbing fixtures provided in any occupancy shall comply with Chapter 29.

[P] 1210.2 Finish materials. Walls, floors and partitions in toilet and bathrooms shall comply with Sections 1210.2.1 through 1210.2.4.

[P] 1210.2.1 Floors and wall bases. In other than *dwelling units*, toilet, bathing and shower room floor finish materials shall have a smooth, hard, nonabsorbent surface. The intersections of such floors with walls shall have a smooth, hard, nonabsorbent vertical base that extends upward onto the walls not less than 4 inches (102 mm).

[P] 1210.2.2 Walls and partitions. Walls and partitions within 2 feet (610 mm) of service sinks, urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of not less than 4 feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

Exception: This section does not apply to the following buildings and spaces:

1. Dwelling units and *sleeping units*.
2. Toilet rooms that are not accessible to the public and that have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

[P] 1210.2.3 Showers. Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 72 inches (1829 mm) above the drain inlet.

[P] 1210.2.4 Waterproof joints. Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

[P] 1210.3 Privacy. Public restrooms shall be visually screened from outside entry or exit doorways to ensure user privacy within the restroom. This provision shall also apply where mirrors would compromise personal privacy. Privacy at water closets and urinals shall be provided in accordance with Sections 1210.3.1 and 1210.3.2.

Exception: Visual screening shall not be required for single-occupant toilet rooms with a lockable door.

[W][P] 1210.3.1 Water closet compartment. Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy. Gender-neutral toilet room water closet compartments shall be in accordance with Section 2902.2.2.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

[W][P] 1210.3.2 Urinal partitions. Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The walls or partitions shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family or assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.
3. Urinals located in gender-neutral toilet facilities shall be in accordance with Section 2902.2.2.

CHAPTER 14

EXTERIOR WALLS

User notes:

About this chapter: *Chapter 14 addresses requirements for exterior walls of buildings. Minimum standards for wall covering materials, such as material performance and fire resistance, installation of wall coverings and the ability of the wall to provide weather protection are provided. This chapter also contains limitations on the areas and heights of combustible wall coverings based on fire separation distances, radiant heat exposure and surface burning characteristics.*

Code development reminder: *Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 1401
GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for *exterior walls*; *exterior wall coverings*; *exterior wall* openings; exterior windows and doors; and architectural *trim.*

SECTION 1402
PERFORMANCE REQUIREMENTS

1402.1 General. The provisions of this section shall apply to *exterior walls*, wall coverings and components thereof.

[W] 1402.2 Weather protection. *Exterior walls* shall provide the building with a weather-resistant *exterior wall envelope*. The *exterior wall envelope* shall include flashing, as described in Section 1404.4. The *exterior wall envelope* shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a *water-resistive barrier* behind the exterior *veneer*, as described in Section 1403.2, and a means for draining water that enters the assembly to the exterior. An air space cavity is not required under the exterior cladding for an exterior wall clad with lapped or panel siding made of plywood, engineered wood, hardboard, or fiber cement. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section 1404.3.

Exceptions:

1. A weather-resistant *exterior wall envelope* shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1403.2 and 1404.4, shall not be required for an *exterior wall envelope* that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:

The *exterior wall envelope* design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the *exterior wall envelope*, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

2.1. *Exterior wall envelope* test assemblies shall include not fewer than one opening, one control joint, one wall/eave interface and one wall sill. Tested openings and penetrations shall be representative of the intended end-use configuration.

2.2. *Exterior wall envelope* test assemblies shall be not less than 4 feet by 8 feet (1219 mm by 2438 mm) in size.

2.3. *Exterior wall envelope* assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (0.297 kN/m^2).

2.4. *Exterior wall envelope* assemblies shall be subjected to a minimum test exposure duration of 2 hours. The exterior wall envelope shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

3. *Exterior insulation and finish systems* (EIFS) complying with Section 1407.4.1.

Interpretation I1402.2: According to Section 1402.2, a rain screen or similar construction method is not required for most exterior siding and cladding, and single-wall construction is allowed. Drainage methods should conform to the manufacturer's installation instructions and other sections of the code.

Note: The "water-resistive barrier" behind the exterior wall covering provides "drainage" of the water that may enter an exterior wall envelope. If water penetrates the exterior wall covering, the felt paper or other *approved* material will direct the water to the bottom of the wall where it will escape to the exterior.

[BS] 1402.3 Structural. *Exterior walls*, and the associated openings, shall be designed and constructed to resist safely the superimposed *loads* required by Chapter 16.

1402.4 Fire resistance. *Exterior walls* shall be fire-resistance rated as required by other sections of this code with opening protection as required by Chapter 7.

[S] ((~~1402.5 Water-resistive barriers.~~ ~~*Exterior walls* on buildings of Type I, II, III or IV construction that are greater than 40 feet (12 192 mm) in height above grade plane and contain a combustible *water-resistive barrier* shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.Combustibility shall be determined in accordance with Section 703.3. For the purposes of this section, *fenestration* products, flashing of *fenestration* products and *water-resistive barrier* flashing and accessories at other locations, including through wall flashings, shall not be considered part of the *water-resistive barrier*.~~

~~**Exceptions:**~~

1. ~~Walls in which the *water-resistive barrier* is the only combustible component and the *exterior wall* has a wall covering of brick, concrete, stone, terra cotta, stucco or steel with minimum thicknesses in accordance with Table 1404.2.~~
2. ~~Walls in which the *water-resistive barrier* is the only combustible component and the *water-resistive barrier* complies with the following:~~
   - 2.1. ~~A peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg when tested on specimens at the thickness intended for use, in accordance with ASTM E1354, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.~~
   - 2.2. ~~A flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723, with test specimen preparation and mounting in accordance with ASTM E2404.~~))

[BS] 1402.6 Flood resistance. For buildings in *flood hazard areas* as established in Section 1612.3, *exterior walls* extending below the elevation required by Section 1612 shall be constructed with flood-damage-resistant materials.

[BS] 1402.7 Flood resistance for coastal high-hazard areas and coastal A zones. For buildings in *coastal high-hazard areas* and coastal A zones as established in Section 1612.3, electrical, mechanical and plumbing system components shall not be mounted on or penetrate through *exterior walls* that are designed to break away under *flood loads*.

SECTION 1403
MATERIALS

1403.1 General. Materials used for the construction of *exterior walls* shall comply with the provisions of this section. Materials not prescribed herein shall be permitted, provided that any such alternative has been *approved*.

1403.2 Water-resistive barrier. Not fewer than one layer of *water-resistive barrier* material shall be attached to the studs or sheathing, with flashing as described in Section 1404.4, in such a manner as to provide a continuous *water-resistive barrier* behind the exterior wall *veneer*.

Water-resistive barriers shall comply with one of the following:

1. No. 15 felt complying with ASTM D226, Type 1.
2. ASTM E2556, Type I or II.
3. ASTM E331 in accordance with Section 1402.2.
4. Other approved materials installed in accordance with the manufacturer's installation instructions.

[BS] 1403.3 Wood. *Exterior walls* of wood construction shall be designed and constructed in accordance with Chapter 23.

[BS] 1403.3.1 Basic hardboard. Basic *hardboard* shall conform to the requirements of ANSI A135.4.

[BS] 1403.3.2 Hardboard siding. *Hardboard* siding shall conform to the requirements of ANSI A135.6 and, where used structurally, shall be so identified by the *label* of an *approved* agency.

[BS] 1403.4 Masonry. *Exterior walls* of masonry construction shall be designed and constructed in accordance with this section and Chapter 21. *Masonry units*, *mortar* and metal accessories used in anchored and adhered *veneer* shall meet the physical requirements of Chapter 21. The backing of anchored and adhered *veneer* shall be of concrete, masonry, steel framing

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where accumulation, condensation or freezing of moisture will not damage the materials.
4. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.

TABLE 1404.3(1)
VAPOR RETARDER MATERIALS AND CLASSES

VAPOR RETARDER CLASS	ACCEPTABLE MATERIALS
I	Sheet polyethylene, nonperforated aluminum foil, or other approved materials with a perm rating of less than or equal to 0.1
II	Kraft-faced fiberglass batts or vapor retarder paint or other approved materials, applied in accordance with the manufacturer's instructions for a perm rating greater than 0.1 and less than or equal to 1.0
III	Latex paint, enamel paint, or other approved materials, applied in accordance with the manufacturer's instructions for a perm rating of greater than 1.0 and less than or equal to 10

Note: Minimum perm ratings for vapor retarders are specified in the definition of "vapor retarder class" in Chapter 2.

[S] TABLE 1404.3(2)
VAPOR RETARDER OPTIONS

CLIMATE ZONE	VAPOR RETARDER CLASS		
	I	II	III[a]
((~~1, 2~~	~~Not permitted~~	~~Not Permitted~~	~~Permitted~~
~~3~~	~~Not permitted~~	~~Permitted~~	~~Permitted~~
~~4 (except Marine)~~	~~Not permitted~~	~~Permitted~~	~~See Table 1404.3(3)~~))
Marine 4 ((~~, 5, 6, 7, 8~~))	Permitted	Permitted	See Table 1404.3(3)

a. See also Sections 1404.3.1 and 1404.3.2.

[S] TABLE 1404.3(3)
CLASS III VAPOR RETARDERS

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a, b]
4	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Continuous insulation with *R*-value ≥ R-2.5 over 2 × 4 wall Continuous insulation with *R*-value ≥ R-3.75 over 2 × 6 wall
((~~5~~	~~Vented cladding over wood structural panels~~ ~~Vented cladding over fiberboard~~ ~~Vented cladding over gypsum~~ ~~Continuous insulation with *R*-value ≥ R-5 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-7.5 over 2 × 6 wall~~
~~6~~	~~Vented cladding over fiberboard~~ ~~Vented cladding over gypsum~~ ~~Continuous insulation with *R*-value ≥ R-7.5 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-11.25 over 2 × 6 wall~~
~~7~~	~~Continuous insulation with *R*-value ≥ R-10 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-15 over 2 × 6 wall~~
~~8~~	~~Continuous insulation with *R*-value ≥ R-12.5 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-20 over 2 × 6 wall~~))

a. Vented cladding shall include vinyl lap siding, polypropylene, or horizontal aluminum siding, brick veneer with airspace as specified in this code, and other approved vented claddings.

b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of the *International Energy Conservation Code*.

[S] TABLE 1404.3(4)
CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER

CLIMATE ZONE	PERMITTED CONDITIONS[a]
((~~3~~	~~Continuous insulation with *R*-value ≥ R-2~~))
4 ((~~, 5, 6~~))	Continuous insulation with *R*-value ≥ R-3 over 2 × 4 wall Continuous insulation with *R*-value ≥ R-5 over 2 × 6 wall
((~~7~~	~~Continuous insulation with *R*-value ≥ R-5 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-7.5 over 2 × 6 wall~~
~~8~~	~~Continuous insulation with *R*-value ≥ R-7.5 over 2 × 4 wall~~ ~~Continuous insulation with *R*-value ≥ R-10 over 2 × 6 wall~~))

a. In addition to the vapor retarder, spray foam with a maximum permeance of 1.5 perms at the installed thickness, applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to comply with the continuous insulation requirement only for the moisture control purposes of this table where the spray foam *R*-value plus any continuous insulation *R*-value provided equals or exceeds the specified continuous insulation *R*-value.

1404.3.1 Spray foam plastic insulation for moisture control with Class III vapor retarders. For purposes of compliance with Table 1404.3(3), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation moisture control requirement where the spray foam *R*-value meets or exceeds the specified continuous insulation *R*-value.

1404.3.2 Hybrid insulation for moisture control with Class III vapor retarders. For the purposes of compliance with Table 1404.3(3), the combined moisture control of spray foam plastic insulation and continuous insulation shall be permitted to be counted toward the continuous *R*-value requirement.

1404.4 Flashing. Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect that moisture to the surface of the exterior wall finish or to a *water-resistive barrier* complying with Section 1403.2 and that is part of a means of drainage complying with Section 1402.2. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of *exterior wall* assemblies, *exterior wall* intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting trim. Where self-adhered membranes are used as flashings of *fenestration* in wall assemblies, those self-adhered flashings shall comply with AAMA 711. Where fluid applied membranes are used as flashing for *exterior wall* openings, those fluid applied membrane flashings shall comply with AAMA 714.

1404.4.1 Exterior wall pockets. In *exterior walls* of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other *approved* means shall be provided to prevent water damage.

1404.4.2 Masonry. Flashing and weep holes in anchored *veneer* designed in accordance with Section 1404.6 shall be located not more than 10 inches (245 mm) above finished ground level above the foundation wall or slab. At other points of support including structural floors, shelf angles and lintels, flashing and weep holes shall be located in the first course of masonry above the support.

1404.5 Wood veneers. Wood *veneers* on *exterior walls* of buildings of Types I, II, III and IV construction shall be not less than 1 inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior *hardboard* siding or 0.375-inch (9.5 mm) exterior-type *wood structural panels* or particleboard and shall conform to the following:

1. The *veneer* shall not exceed 40 feet (12 190 mm) in height above grade. Where *fire-retardant-treated wood* is used, the height shall not exceed 60 feet (18 290 mm) in height above grade.
2. The *veneer* is attached to or furred from a noncombustible backing that is fire-resistance rated as required by other provisions of this code.
3. Where open or spaced wood *veneers* (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the building wall.

[BS] 1404.6 Anchored masonry veneer. *Anchored masonry veneer* shall comply with the provisions of Sections 1404.6 through 1404.9 and Sections 12.1 and 12.2 of TMS 402.

[BS] 1404.6.1 Tolerances. *Anchored masonry veneers* in accordance with Chapter 14 are not required to meet the tolerances in Article 3.3 F1 of TMS 602.

[BS] 1404.6.2 Seismic requirements. *Anchored masonry veneer* located in *Seismic Design Category* C, D, E or F shall conform to the requirements of Section 12.2.2.11 of TMS 402.

[BS] 1404.7 Stone veneer. Anchored stone *veneer* units not exceeding 10 inches (254 mm) in thickness shall be anchored directly to masonry, concrete or to stud construction by one of the following methods:

[BS] 1404.10.1.2 Flashing. Flashing shall comply with the applicable requirements of Sections 1404.4 and 1404.10.1.2.1.

[BS] 1404.10.1.2.1 Flashing at foundation. A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48 mm) or 26 gage galvanized or plastic with a minimum vertical attachment flange of 3-1/2 inches (89 mm) shall be installed to extend not less than 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section 1404.4. The *water-resistive barrier* shall lap over the exterior of the attachment flange of the screed or flashing.

[BS] 1404.10.1.3 Clearances. On exterior stud walls, *adhered masonry veneer* shall be installed not less than 4 inches (102 mm) above the earth, or not less than 2 inches (51 mm) above paved areas, or not less than 1/2 inch (12.7 mm) above exterior walking surfaces that are supported by the same foundation that supports the *exterior wall*.

[BS] 1404.10.1.4 Adhered masonry veneer installed with lath and mortar. Exterior *adhered masonry veneer* installed with lath and *mortar* shall comply with the following.

[BS] 1404.10.1.4.1 Lathing. Lathing shall comply with the requirements of Section 2510.

[BS] 1404.10.1.4.2 Scratch coat. A nominal 1/2-inch-thick (12.7 mm) layer of *mortar* complying with the material requirements of Sections 2103 and 2512.2 shall be applied, encapsulating the lathing. The surface of this *mortar* shall be scored horizontally, resulting in a scratch coat.

[BS] 1404.10.1.4.3 Adhering veneer. The masonry *veneer* units shall be adhered to the *mortar* scratch coat with a nominal 1/2-inch-thick (12.7 mm) setting bed of *mortar* complying with Sections 2103 and 2512.2 applied to create a full setting bed for the back of the masonry *veneer* units. The masonry *veneer* units shall be worked into the setting bed resulting in a nominal 3/8-inch (9.5 mm) setting bed after the masonry *veneer* units are applied.

[BS] 1404.10.1.5 Adhered masonry veneer applied directly to masonry and concrete. *Adhered masonry veneer* applied directly to masonry or concrete shall comply with the applicable requirements of Section 1404.10 and with the requirements of Section 1404.10.1.4 or 2510.7.

[BS] 1404.10.1.6 Cold weather construction. Cold weather construction of *adhered masonry veneer* shall comply with the requirements of Sections 2104 and 2512.4.

[BS] 1404.10.1.7 Hot weather construction. Hot weather construction of *adhered masonry veneer* shall comply with the requirements of Section 2104.

[S][BS] 1404.10.2 Exterior adhered masonry veneers—porcelain tile. ((~~Adhered~~)) Individual adhered porcelain tile units weighing more than 3.5 pounds per square foot (0.17 kN/m^2) shall not exceed 48 inches (1219 mm) in any face dimension nor more than 9 square feet (0.8 m^2) in total face area and shall not weigh more than 6 pounds per square foot (0.29 kN/m^2). ((~~Adhered~~)) Such adhered units weighing less than or equal to 3.5 pounds per square foot (0.17 kN/m^2) shall not exceed 72 inches (1829 mm) in any face dimension nor more than 17.5 square feet (1.6 m^2) in total face area. Porcelain tile shall be adhered to an approved backing system.

[BS] 1404.10.3 Interior adhered masonry veneers. Interior *adhered masonry veneers* shall have a maximum weight of 20 psf (0.958 kg/m^2) and shall be installed in accordance with Section 1404.10. Where the interior *adhered masonry veneer* is supported by wood construction, the supporting members shall be designed to limit deflection to 1/600 of the span of the supporting members.

[BS] 1404.11 Metal veneers. *Veneers* of metal shall be fabricated from *approved* corrosion-resistant materials or shall be protected front and back with porcelain enamel, or otherwise be treated to render the metal resistant to corrosion. Such *veneers* shall be not less than 0.0149-inch (0.378 mm) nominal thickness sheet steel mounted on wood or metal furring strips or approved sheathing on *light-frame construction*.

[BS] 1404.11.1 Attachment. Exterior metal *veneer* shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other *approved* devices or methods. The spacing of the fastenings or ties shall not exceed 24 inches (610 mm) either vertically or horizontally, but where units exceed 4 square feet (0.4 m^2) in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by W 1.7 wire. Such attachments and their supports shall be designed and constructed to resist the wind *loads* as specified in Section 1609 for components and cladding.

1404.11.2 Weather protection. Metal supports for exterior metal *veneer* shall be protected by painting, galvanizing or by other equivalent coating or treatment. Wood studs, furring strips or other wood supports for exterior metal *veneer* shall be *approved* pressure-treated wood or protected as required in Section 1402.2. Joints and edges exposed to the weather shall be caulked with *approved* durable waterproofing material or by other *approved* means to prevent penetration of moisture.

1404.11.3 Backup. Masonry backup shall not be required for metal *veneer* unless required by the fire-resistance requirements of this code.

SECTION 1407
EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

1407.1 General. The provisions of this section shall govern the materials, construction and quality of *exterior insulation and finish systems* (EIFS) for use as *exterior wall coverings* in addition to other applicable requirements of Chapters 7, 14, 16, 17 and 26.

1407.2 Performance characteristics. EIFS shall be constructed such that it meets the performance characteristics required in ASTM E2568.

[BS] 1407.3 Structural design. The underlying structural framing and substrate shall be designed and constructed to resist *loads* as required by Chapter 16.

1407.4 Weather resistance. EIFS shall comply with Section 1402 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's application instructions.

1407.4.1 EIFS with drainage. EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance the requirements of ASTM E2273 and is required on framed walls of Type V construction, Group R1, R2, R3 and R4 occupancies.

1407.4.1.1 Water-resistive barrier. For EIFS with drainage, the *water-resistive barrier* shall comply with Section 1403.2 or ASTM E2570.

1407.5 Installation. Installation of the EIFS and EIFS with drainage shall be in accordance with the EIFS manufacturer's instructions.

[S] ((~~1407.6 Special inspections.~~ ~~EIFS installations shall comply with the provisions of Sections 1704.2 and 1705.17.~~))

SECTION 1408
HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATES (HPL)

1408.1 General. The provisions of this section shall govern the materials, construction and quality of High-Pressure Decorative *Exterior-Grade Compact Laminates (HPL)* for use as *exterior wall coverings* in addition to other applicable requirements of Chapters 14 and 16.

1408.2 Exterior wall covering. HPL used as *exterior wall covering* or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1408.4 through 1408.14.

1408.3 Architectural trim and embellishments. HPL used as architectural trim or embellishments shall comply with Sections 1408.7 through 1408.14.

[BS] 1408.4 Structural design. HPL systems shall be designed and constructed to resist wind *loads* as required by Chapter 16 for components and cladding.

1408.5 Approval. Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind *loads*.

1408.6 Weather resistance. HPL systems shall comply with Section 1402 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's instructions.

1408.7 Durability. HPL systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1408 for the duration of use.

1408.8 Fire-resistance rating. Where HPL systems are used on *exterior walls* required to have a *fire-resistance rating* in accordance with Section 705, evidence shall be submitted to the building official that the required *fire-resistance rating* is maintained.

Exception: HPL systems not containing foam plastic insulation, which are installed on the outer surface of a fire-resistance-rated *exterior wall* in a manner such that the attachments do not penetrate through the entire *exterior wall* assembly, shall not be required to comply with this section.

1408.9 Surface-burning characteristics. Unless otherwise specified, HPL shall have a *flame spread index* of 75 or less and a *smoke-developed index* of 450 or less when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E84 or UL 723.

1408.10 Types I, II, III and IV construction. Where installed on buildings of Types I, II, III and IV construction, HPL systems shall comply with Sections 1408.10.1 through 1408.10.4, or Section 1408.11.

1408.10.1 Surface-burning characteristics. HPL shall have a *flame spread index* of not more than 25 and a *smoke-developed index* of not more than 450 when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E84 or UL 723.

CHAPTER 15
ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

User notes:

About this chapter: *Chapter 15 provides minimum requirements for the design and construction of roof assemblies and rooftop structures. The criteria address the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is largely prescriptive in nature and is based on decades of experience with various traditional materials, but it also recognizes newer products. Section 1511 addresses rooftop structures, which include penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.*

Code development reminder: *Code change proposals to sections preceded by the designation [BF], [BG] or [P] will be considered by one of the code development committees meeting during the 2021 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 1501
GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of *roof assemblies*, and *rooftop structures*.

SECTION 1502
ROOF DRAINAGE

[S][P] 1502.1 General. Design and installation of roof drainage systems shall comply with this section, Section 1611 of this code and Chapter 11 of the ((~~*International*~~)) *Uniform Plumbing Code*.

[S][P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Section 1611 of this code and Chapter 11 of the ((~~*International*~~)) *Uniform Plumbing Code*.

1502.3 Scuppers. Where *scuppers* are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the *scuppers* shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. *Scuppers* shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing *scuppers*.

1502.4 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, *private garages* and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.

SECTION 1503
WEATHER PROTECTION

1503.1 General. *Roof decks* shall be covered with *approved roof coverings* secured to the building or structure in accordance with the provisions of this chapter. *Roof coverings* shall be designed in accordance with this code, and installed in accordance with this code and the manufacturer's *approved* instructions.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent water from entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with *parapet walls* and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

1503.3 Parapet walls. Parapet walls shall be coped or covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

1503.3.1 Fire-resistance-rated parapet walls. *Parapet walls* required by Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the *parapet wall* such that the *fire-resistance rating* of the wall is not decreased.

TABLE 1504.9—continued
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS[a, b, c]

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																		
		Exposure B									Exposure C[d]									
		≤ 95	100	105	110	115	120	130	140	150	≤ 95	100	105	110	115	120	130	140	150
ASTM D1863 (No. 6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Interpolation shall be permitted for mean roof height and parapet height.
b. Basic design wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.
c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

SECTION 1505
FIRE CLASSIFICATION

[BF] 1505.1 General. *Roof assemblies* shall be divided into the classes defined in this section. Class A, B and C *roof assemblies* and *roof coverings* required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, *fire-retardant-treated wood roof coverings* shall be tested in accordance with ASTM D2898. The minimum *roof coverings* installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

Exception: *Skylights and sloped glazing* that comply with Chapter 24 or Section 2610.

[S] TABLE 1505.1
MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION (([a],)) [b]

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C[c]	B	C[c]	B	B	C[c]

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Unless otherwise required in accordance with the *International Wildland-Urban Interface Code* or due to the location of the building. ((~~within a fire district in accordance with Appendix D.~~))
b. Nonclassified roof coverings shall be permitted on buildings of Group R-3 and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.
c. Buildings that are not more than two stories above grade plane and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles constructed in accordance with Section 1505.7.

[BF] 1505.2 Class A roof assemblies. Class A *roof assemblies* are those that are effective against severe fire test exposure. Class A *roof assemblies* and *roof coverings* shall be *listed* and identified as Class A by an *approved* testing agency. Class A *roof assemblies* shall be permitted for use in buildings or structures of all types of construction.

Exceptions:

1. Class A *roof assemblies* include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A *roof assemblies* also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
3. Class A *roof assemblies* include minimum 16 ounce per square foot (0.0416 kg/m^2) copper sheets installed over combustible decks.
4. Class A *roof assemblies* include slate installed over ASTM D226, Type II *underlayment* over combustible decks.

[BF] 1505.3 Class B roof assemblies. Class B *roof assemblies* are those that are effective against moderate fire-test exposure. Class B *roof assemblies* and *roof coverings* shall be *listed* and identified as Class B by an *approved* testing agency.

[BF] 1505.4 Class C roof assemblies. Class C *roof assemblies* are those that are effective against light fire-test exposure. Class C *roof assemblies* and *roof coverings* shall be *listed* and identified as Class C by an *approved* testing agency.

[BF] 1505.5 Nonclassified roofing. Nonclassified roofing is *approved* material that is not *listed* as a Class A, B or C *roof covering*.

TABLE 1509.2
ROOF COATING MATERIAL STANDARDS

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphaltic emulsion coating	ASTM D1227
Asphalt coating	ASTM D2823
Asphalt roof coating	ASTM D4479
Aluminum-pigmented asphalt coating	ASTM D2824
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

SECTION 1510
RADIANT BARRIERS INSTALLED ABOVE DECK

[BF] 1510.1 General. A *radiant barrier* installed above a deck shall comply with Sections 1510.2 through 1510.4.

[BF] 1510.2 Fire testing. *Radiant barriers* shall be permitted for use above decks where the *radiant barrier* is covered with an *approved roof covering* and the system consisting of the *radiant barrier* and the *roof covering* complies with the requirements of either FM 4450 or UL 1256.

[BF] 1510.3 Installation. The low *emittance* surface of the *radiant barrier* shall face the continuous airspace between the *radiant barrier* and the roof covering.

[BF] 1510.4 Material standards. A *radiant barrier* installed above a deck shall comply with ASTM C1313/1313M.

SECTION 1511
ROOFTOP STRUCTURES

[BG] 1511.1 General. The provisions of this section shall govern the construction of *rooftop structures*.

1511.1.1 Area limitation. The aggregate area of *penthouses* and other enclosed *rooftop structures* shall not exceed one-third the area of the supporting roof deck. Such *penthouses* and other enclosed *rooftop structures* shall not be required to be included in determining the *building area* or number of stories as regulated by Section 503.1. The area of such *penthouses* shall not be included in determining the *fire area* specified in Section 901.7.

[BG] 1511.2 Penthouses. *Penthouses* in compliance with Sections 1511.2.1 through 1511.2.4shall be considered as a portion of the *story* directly below the *roof deck* on which such *penthouses* are located. Other *penthouses* shall be considered as an additional *story* of the building.

[BG] 1511.2.1 Height above roof deck. *Penthouses* constructed on buildings of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the *roof deck* as measured to the average height of the roof of the *penthouse*. *Penthouses* located on the roof of buildings of Type I construction shall not be limited in height.

Exception: Where used to enclose tanks or elevators that travel to the roof level, penthouses shall be permitted to have a maximum height of 28 feet (8534 mm) above the roof deck.

[S][BG] 1511.2.2 Use limitations. *Penthouses* shall not be used for purposes other than the shelter of mechanical or electrical equipment, tanks, elevators and related machinery, exit stairways or vertical *shaft* openings in the roof assembly, including ancillary spaces used to access elevators and stairways.

[BG] 1511.2.3 Weather protection. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical and electrical equipment and the building interior from the elements.

[BG] 1511.2.4 Type of construction. Penthouses shall be constructed of building elements as required for the type of construction of the building on which such penthouses are built.

Exceptions:

1. On buildings of Type I construction, the *exterior walls* and roofs of *penthouses* with a *fire separation distance* greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour *fire-resistance rating*. The *exterior walls* and roofs of *penthouses* with a *fire separation distance* of 20 feet (6096 mm) or greater shall not be required to have a *fire-resistance rating*.
2. On buildings of Type I construction two stories or less in height above *grade plane* or of Type II construction, the *exterior walls* and roofs of *penthouses* with a *fire separation distance* greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour *fire-resistance rating* or a lesser *fire-resistance rating* as required by Table 705.5 and be constructed of *fire-retardant-treated wood*. The *exterior*

2. The *fire separation distance* shall be not less than 20 feet (6096 mm) and the *mechanical equipment screen* shall be constructed of *fire-retardant-treated wood* complying with Section 2303.2 for exterior installation.
3. Where exterior wall covering panels are used, the panels shall have a *flame spread index* of 25 or less when tested in the minimum and maximum thicknesses intended for use, with each face tested independently in accordance with ASTM E84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an *exterior wall* assembly in accordance with NFPA 285, the panels shall be installed on the face of the *mechanical equipment screen* supporting structure in the same manner as they were installed on the tested *exterior wall* assembly.

[BG] 1511.6.3 Type V construction. The height of mechanical equipment screens located on the *roof decks* of buildings of Type V construction, as measured from *grade plane* to the highest point on the *mechanical equipment screen*, shall be permitted to exceed the maximum *building height* allowed for the building by other provisions of this code where complying with any one of the following limitations, provided that the *fire separation distance* is greater than 5 feet (1524 mm):

1. Where the *fire separation distance* is not less than 20 feet (6096 mm), the height above *grade plane* of the *mechanical equipment screen* shall not exceed 4 feet (1219 mm) more than the maximum *building height* allowed.
2. The *mechanical equipment screen* shall be constructed of noncombustible materials.
3. The *mechanical equipment screen* shall be constructed of *fire-retardant-treated wood* complying with Section 2303.2 for exterior installation.
4. Where the *fire separation distance* is not less than 20 feet (6096 mm), the *mechanical equipment screen* shall be constructed of materials having a *flame spread index* of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E84 or UL 723.

[BG] 1511.7 Other rooftop structures. *Rooftop structures* not regulated by Sections 1511.2 through 1511.6 shall comply with Sections 1511.7.1 through 1511.7.5, as applicable.

[BG] 1511.7.1 Aerial supports. Aerial supports shall be constructed of noncombustible materials.

Exception: Aerial supports not greater than 12 feet (3658 mm) in height as measured from the *roof deck* to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

[BG] 1511.7.2 Bulkheads. Bulkheads used for the shelter of mechanical or electrical equipment or vertical *shaft* openings in the *roof assembly* shall comply with Section 1511.2 as *penthouses*. Bulkheads used for any other purpose shall be considered as an additional story of the building.

[BG] 1511.7.3 Dormers. Dormers shall be of the same type of construction as required for the roof in which such dormers are located or the *exterior walls* of the building.

[BG] 1511.7.4 Fences. Fences and similar structures shall comply with Section 1511.6 as *mechanical equipment screens*.

[BG] 1511.7.5 Flagpoles. Flagpoles and similar structures shall not be required to be constructed of noncombustible materials and shall not be limited in height or number.

[S] ((~~[BG] 1511.8 Structural fire resistance.~~ ~~The structural frame and roof construction supporting *loads* imposed upon the roof by any *rooftop structure* shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing *rooftop structures*.~~))

SECTION 1512
REROOFING

Note: See International Energy Conservation Code for insulation requirements for reroofing.

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of 1/4 unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage*.
2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage*. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2. *

CHAPTER 16

STRUCTURAL DESIGN

User notes:

About this chapter: *Chapter 16 establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use. The loads specified herein along with the required load combinations have been established through research and service performance of buildings and structures. The application of these loads and adherence to the serviceability criteria enhance the protection of life and property.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 1601
GENERAL

[S] 1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

Exceptions:

1. Carports are not required to comply with this chapter if they satisfy all the following criteria:
   1.1. Accessory to Group R-3 occupancies,
   1.2. Used to shelter only vehicles, trailers or vessels,
   1.3. Constructed of metal, plastic or fabric,
   1.4. No more than 3 pounds per square foot in total weight, and
   1.5. No more than 300 square feet covered area.
2. Temporary tents and similar structures are not required to comply with this chapter if they satisfy all the following criteria:
   2.1 The occupant load is less than 100;
   2.2 The structure is fully or partially enclosed and 400 square feet or less in area; or are entirely unenclosed and 700 square feet or less in area;
   2.3 The structure is constructed of metal, plastic or fabric; and
   2.4 The structure is no more than 3 pounds per square foot in total weight.

SECTION 1602
NOTATIONS

1602.1 Notations. The following notations are used in this chapter:

D = Dead load.

D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.

E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load in accordance with Chapter 5 of ASCE 7.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Live load.

L_r = Roof live load.

R = Rain load.

S = Snow load.

T = Cumulative effects of self-straining load forces and effects.

V_{asd} = Allowable stress design wind speed, miles per hour (mph) (km/hr) where applicable.

V = Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609.3(1) through 1609.3(12) or ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603
CONSTRUCTION DOCUMENTS

[S] 1603.1 General. *Construction documents* shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents*.

Exception: *Construction documents* for buildings constructed in accordance with the *conventional light-frame construction* provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. ((~~Ground snow~~)) Snow load. ((~~, p_g~~))
3. Basic design wind speed, V, miles per hour (mph) (km/hr) and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1 and wind exposure.
4. *Seismic design category* and *site class*.
5. Flood design data, if located in *flood hazard areas* established in Section 1612.3.
6. Design load-bearing values of soils.
7. Rain load data.

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor *live load* used in the design shall be indicated for floor areas. Use of *live load* reduction in accordance with Section 1607.12 shall be indicated for each type of *live load* used in the design.

1603.1.2 Roof live and snow load. The ((~~*roof live load*~~)) roof live and snow load used in the design shall be indicated for roof areas (Sections 1607.14 and 1608).

1603.1.3 ((~~Roof snow load data~~)) Reserved. ((~~The ground snow *load*, p_g, shall be indicated. In areas where the ground snow *load*, p_g, exceeds 10 pounds per square foot (psf) (0.479 kN/m^2), the following additional information shall also be provided, regardless of whether snow *loads* govern the design of the roof:~~

1. ~~Flat-roof snow *load*, p_f.~~
2. ~~Snow exposure factor, C_e.~~
3. ~~Snow *load* importance factor, I_s.~~
4. ~~Thermal factor, C_t.~~
5. ~~Slope factor(s), C_s.~~
6. ~~Drift surcharge load(s), p_d, where the sum of p_d and p_f exceeds 20 psf (0.96 kN/m^2).~~
7. ~~Width of snow drift(s), w.~~))

1603.1.4 Wind design data. The following information related to wind *loads* shall be shown, regardless of whether wind *loads* govern the design of the lateral force-resisting system of the structure:

1. Basic design *wind speed*, V, miles per hour and *allowable stress design wind speed*, V_{asd}, as determined in accordance with Section 1609.3.1.
2. *Risk category*.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the *registered design professional* responsible for the design of the structure, pounds per square foot (kN/m^2).

1603.1.5 Earthquake design data. The following information related to seismic *loads* shall be shown, regardless of whether seismic *loads* govern the design of the lateral force-resisting system of the structure:

1. *Risk category*.

2. Seismic importance factor, I_e.
3. Mapped spectral response acceleration parameters, S_S and S_1.
4. *Site class*.
5. Design spectral response acceleration parameters, S_{DS} and S_{D1}.
6. *Seismic design category*.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s), *CS*.
10. Response modification coefficient(s), *R*.
11. Analysis procedure used.

1603.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the *construction documents*.

1603.1.7 Flood design data. For buildings located in whole or in part in *flood hazard areas* as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's *Flood Insurance Rate Map* (FIRM), shall be shown, regardless of whether *flood loads* govern the design of the building:

1. *Flood design* class assigned according to ASCE 24.
2. In *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*, the elevation of the proposed *lowest floor*, including the basement.
3. In *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*, the elevation to which any nonresidential building will be dry floodproofed.
4. In *coastal high hazard areas* and *coastal A zones*, the proposed elevation of the bottom of the lowest horizontal structural member of the *lowest floor*, including the basement.

1603.1.8 Special loads. Special *loads* that are applicable to the design of the building, structure or portions thereof, including but not limited to the *loads* of machinery or equipment, and that are greater than specified floor and roof *loads* shall be specified by their descriptions and locations.

1603.1.8.1 Photovoltaic panel systems. The *dead load* of rooftop-mounted *photovoltaic panel systems*, including rack support systems, shall be indicated on the *construction documents*.

Note: Floor and roof design load provisions regarding posting of live loads, issuance of certificates of occupancy and restrictions on loading are located in Section 107 Floor and Roof Design Loads.

1603.1.9 Roof rain load data. Rain intensity, *i* (in/hr) (cm/hr), shall be shown regardless of whether rain *loads* govern the design.

SECTION 1604
GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with *strength* design, *load and resistance factor* design, *allowable stress design*, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604.2 Strength. Buildings and *other structures*, and parts thereof, shall be designed and constructed to support safely the *factored loads* in load combinations defined in this code without exceeding the appropriate strength *limit states* for the materials of construction. Alternatively, buildings and *other structures*, and parts thereof, shall be designed and constructed to support safely the *nominal loads* in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the *building official*.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3.

[W] TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.

III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:
	• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.
	• Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500.
	• Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, with an occupant load greater than 250.
	• Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500.
	• Group I-2, Condition 1 occupancies with 50 or more care recipients.
	• Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities.
	• Group I-3 occupancies.
	• Any other occupancy with an occupant load greater than 5,000.[a]
	• Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV.
	• Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that:
	  • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and
	  • Are sufficient to pose a threat to the public if released.[b]

IV	Buildings and other structures designated as essential facilities, including but not limited to:
	• Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities.
	• Ambulatory care facilities having emergency surgery or emergency treatment facilities.
	• Fire, rescue, ambulance and police stations and emergency vehicle garages
	• Designated earthquake, hurricane or other emergency shelters.
	• Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
	• Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
	• Buildings and other structures containing quantities of highly toxic materials that:
	  • Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and
	  • Are sufficient to pose a threat to the public if released.[b]
	• Aviation control towers, air traffic control centers and emergency aircraft hangars.
	• Buildings and other structures having critical national defense functions.
	• Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same *risk category*, it shall be assigned the classification of the highest *risk category* corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher *risk category*, both portions shall be assigned to the higher *risk category*.

Section 2.3 or 2.4 of ASCE 7, and in Section 1605.2 shall be permitted. Where the load combinations specified in ASCE 7, Section 2.3 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807.2.3.

1605.2 Alternative allowable stress design load combinations. In lieu of the load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. Where using these alternative allowable stress load combinations that include wind or seismic *loads*, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind *loads*, only two-thirds of the minimum *dead load* likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic *load* combinations for proportioning foundations for loadings, which include seismic *loads*, the vertical seismic *load effect*, E_v, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, Section 2.3.6 shall be used.

$D + L + (L_r \text{ or } S \text{ or } R)$ **(Equation 16-1)**

$D + L + 0.6W$ **(Equation 16-2)**

$D + L + 0.6W + S/2$ **(Equation 16-3)**

$D + L + S + 0.6W/2$ **(Equation 16-4)**

$D + L + S + E/1.4$ **(Equation 16-5)**

$0.9D + E/1.4$ **(Equation 16-6)**

Exceptions:

1. Crane hook *loads* need not be combined with *roof live loads* or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow *loads* of 30 pounds per square foot (1.44 kN/m^2) or less and *roof live loads* of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m^2), 20 percent shall be combined with seismic loads.

SECTION 1606
DEAD LOADS

1606.1 General. *Dead loads* are those *loads* defined in Chapter 2 of this code. *Dead loads* shall be considered to be permanent loads.

1606.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the *building official*.

1606.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic panel systems. The weight of *photovoltaic panel systems*, their support system, and ballast shall be considered as dead *load*.

1606.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as *dead load*. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe *load* effects on the structure.

[S] 1606.6 Solar zone for solar-ready roof. Where a *solar zone* is required by the *International Energy Conservation Code*, it shall be designed for an assumed dead load of 5 pounds per square foot in addition to other required live and dead loads. An area of 2 square feet for each 1000 square feet of solar zone area shall be designed for an assumed dead load of 175 pounds per

square foot. If the actual weight of the system at the time of installation exceeds the assumed loads in this section, the actual weight shall be used to verify the adequacy of the roof structure. This area shall be located within or adjacent to the solar zone. The as-designed dead load and live load for the *solar zone* shall be clearly marked on the *construction documents*.

Note: The 175 psf represents the weight of the inverters necessary for PV systems. See *International Energy Conservation Code* Section C412.

SECTION 1607
LIVE LOADS

1607.1 General. *Live loads* are those loads defined in Chapter 2 of this code.

[S] TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
1.	Apartments (see residential)		—	—	—
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms		150[b]	—	—
4.	Assembly areas	Fixed seats (fastened to floor)	60[a]	—	—
		Follow spot, projections and control rooms	50		
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[b]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands	100[a] (See Section 1607.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607.19)		
		Other assembly areas	100[a]		
5.	Balconies and decks		1.5 times the live load for the area served, not required to exceed 100	—	—
6.	Catwalks for maintenance and service access		40	300	—
7.	((~~Cornices~~)) *Canopies*[d] and cornices		60	—	—
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants		100[a]	—	—
10.	Dwellings (see residential)		—	—	—
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)		—	300	—
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)		—	200	—
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders		See Section 1607.17		—
15.	Garages	Passenger vehicles only	40[c]	See Section 1607.7	—
		Trucks and buses	See Section 1607.8		
16.	Handrails, guards and grab bars		See Section 1607.9		—
17.	Helipads		See Section 1607.6		—

[S] TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
18.	Hospitals	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)		—	—	—
20.	Libraries	Corridors above first floor	80	1,000	—
		Reading rooms	60	1,000	—
		Stack rooms	150[b]	1,000	Section 1607.18
21.	Manufacturing	Heavy	250[b]	3,000	—
		Light	125[b]	2,000	
22.	((~~Marquees, except one- and two-family dwellings~~)) Reserved.		75	—	—
23.	Office buildings	Corridors above first floor	80	2,000	—
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—	
		Lobbies and first-floor corridors	100	2,000	
		Offices	50	2,000	
24.	Penal institutions	Cell blocks	40	—	—
		Corridors	100		
25.	Recreational uses	Bowling alleys, poolrooms and similar uses	75[a]	—	—
		Dance halls and ballrooms	100[a]		
		Gymnasiums	100[a]		
		Ice skating rinks	250[b]		
		Roller skating rinks	100[a]		
26.	Residential	One- and two-family dwellings:		—	Section 1607.22
		Uninhabitable attics without storage	10		
		Uninhabitable attics with storage	20		
		Habitable attics and sleeping areas	30		
		Canopies, including marquees	20		
		Non-residential portion of live-work units	50[a]		
		All other areas	40		
		Hotels and multifamily dwellings:			
		Private rooms and corridors serving them	40		
		Public rooms[a] and corridors serving them	100		

[S] TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
27.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	—	Section 1607.14.2
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for occupancies other than assembly	Same as occupancy served	—	
		Vegetative and landscaped roofs:		—	
		Roof areas not intended for occupancy	20	—	
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for other occupancies	Same as occupancy served	—	
		Awnings and canopies:		—	
		Fabric construction supported by a skeleton structure	5[a]	—	
		All other construction, except one- and two-family dwellings	20	—	
		Primary roof members exposed to a work floor:			Section 1607.15.2
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages	—	2,000	
		All other primary roof members	—	300	
		All roof surfaces subject to maintenance workers	—	300	
28.	Schools	Classrooms	40	1,000	—
		Corridors above first floor	80	1,000	
		First-floor corridors	100	1,000	
29.	Scuttles, skylight ribs and accessible ceilings		—	200	—
30.	Sidewalks, vehicular driveways and yards, subject to trucking		250[b]	8,000	Section 1607.20
31.	Stairs and exits	One- and two-family dwellings	40	300	Section 1607.21
		All other	100	300	Section 1607.21
32.	Storage areas above ceilings		20	—	—
33.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250[b]	—	—
		Light	125[b]		
34.	Stores	Retail:			—
		First floor	100	1,000	
		Upper floors	75	1,000	
		Wholesale, all floors	125[b]	1,000	
35.	Vehicle barriers		See Section 1607.10		—
36.	Walkways and elevated platforms (other than exitways)		60	—	—
37.	Yards and terraces, pedestrian		100[a]	—	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m^3.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607.12.1.2 or Item 1 of Section 1607.12.2.

c. Live load reduction is only permitted in accordance with Section 1607.12.1.3 or Item 2 of Section 1607.12.2.

d. This loading condition need only be considered for *canopies* that meet all of the following conditions:

1. The upper surface is sloped less than 30 degrees (0.5 rad) from horizontal; and
2. The *canopy* is located adjacent to a right of way or assembly area; and

3. The *canopy* is located less than 10 feet (3048 mm) above the ground at all points, or less than 10 feet (3048 mm) below an adjacent roof, or less than 10 feet (3048 mm) from operable openings above or adjacent to the level of the *canopy*.

For other *canopies*, roof loads as specified in this chapter shall be applied. *Canopy* is defined in Section 202.

1607.2 Loads not specified. For occupancies or uses not designated in Section 1607, the *live load* shall be determined in accordance with a method *approved* by the *building official*.

1607.3 Uniform live loads. The *live loads* used in the design of buildings and *other structures* shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed *live loads* given in Table 1607.1.

1607.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed *live loads* prescribed in Section 1607.3 or the concentrated *live loads*, given in Table 1607.1, whichever produces the greater *load effects*. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of 2-1/2 feet by 2-1/2 feet (762 mm by 762 mm) and shall be located so as to produce the maximum *load effects* in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified *live load* is 80 psf (3.83 kN/m^2) or greater. The partition *load* shall be not less than a uniformly distributed *live load* of 15 psf (0.72 kN/m^2).

1607.6 Helipads. Helipads shall be designed for the following *live loads*:

1. A uniform *live load*, *L*, as specified in Items 1.1 and 1.2. This *load* shall not be reduced.
   1.1. 40 psf (1.92 kN/m^2) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.
   1.2. 60 psf (2.87 kN/m^2) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).
2. A single concentrated *live load*, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated *load* is not required to act concurrently with other uniform or concentrated *live loads*.
3. Two single concentrated *live loads*, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated *live loads*.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

1607.7 Passenger vehicle garages. Floors in garages or portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed *live loads* indicated in Table 1607.1 or the following concentrated *load*:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).
2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607.8 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle *loads* greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.8.1 through 1607.8.5.

1607.8.1 Loads. Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such *loads* shall be designed using the vehicular *live loads*, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607.8.2 Fire truck and emergency vehicles. Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following *loads*:

1. The actual operational *loads*, including outrigger reactions and contact areas of the vehicles as stipulated and *approved* by the *building official*.
2. The live loading specified in Section 1607.8.1.

1607.8.3 Heavy vehicle garages. Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular *live loads* and *load* placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such *loads* and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.9 kN/m^2). This *live load* shall not be reduced.

1607.8.4 Forklifts and movable equipment. Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment *load* and the individual wheel *loads* for the anticipated vehicles as specified by the owner of the facility. These *loads* shall be posted in accordance with Section 1607.8.5.

1607.8.4.1 Impact and fatigue. *Impact loads* and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel *loads* shall be increased by 30 percent to account for impact.

[S] 1607.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section ((~~106.1~~)) 107.

1607.9 Loads on handrails, guards, grab bars and seats. *Handrails* and *guards* shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.2.

1607.9.1 Handrails and guards. *Handrails* and *guards* shall be designed to resist a linear *load* of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. Glass *handrail* assemblies and *guards* shall comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated *load* required by Section 1607.9.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an *occupant load* less than 50, the minimum *load* shall be 20 pounds per foot (0.29 kN/m).

1607.9.1.1 Concentrated load. *Handrails* and *guards* shall be designed to resist a concentrated *load* of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

1607.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607.9.2 Grab bars, shower seats and accessible benches. Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated *load* of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum *load effects*.

1607.10 Vehicle barriers. *Vehicle barriers* for passenger vehicles shall be designed to resist a concentrated *load* of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an *approved* method that contains provisions for traffic railings.

1607.11 Impact loads. The *live loads* specified in Sections 1607.3 through 1607.10 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.11.1 Elevators. Members, elements and components subject to dynamic *loads* from elevators shall be designed for *impact loads* and deflection limits prescribed by ASME A17.1/CSA B44.

1607.11.2 Machinery. For the purpose of design, the weight of machinery and moving *loads* shall be increased as follows to allow for impact:

1. Light machinery, shaft- or motor-driven, 20 percent.
2. Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607.11.3 Elements supporting hoists for façade access and building maintenance equipment. In addition to any other applicable *live loads*, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a *live load* of 2.5 times the rated *load* of the hoist or the stall *load* of the hoist, whichever is larger.

1607.11.4 Fall arrest, lifeline, and rope descent system anchorages. In addition to any other applicable *live loads*, fall arrest, lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a *live load* of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the *load* can be applied.

1607.12.1.3 Passenger vehicle garages. The *live loads* shall not be reduced in passenger vehicle garages.

Exception: The *live loads* for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the *live load* be shall be not less than L as calculated in Section 1607.12.1.

1607.12.2 Alternative uniform live load reduction. As an alternative to Section 1607.12.1 and subject to the limitations of Table 1607.1, uniformly distributed *live loads* are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the *live load* exceeds 100 psf (4.79 kN/m^2) except that the design *live load* for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

   Exception: For uses other than storage, where *approved*, additional *live load* reductions shall be permitted where shown by the *registered design professional* that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the *live loads* for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.
3. For *live loads* not exceeding 100 psf (4.79 kN/m^2), the design *live load* for any structural member supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with Equation 16-8
4. For one-way slabs, the area, A, for use in Equation 16-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

   $R = 0.08(A - 150)$ **(Equation 16-8)**

   For SI: $R = 0.861(A - 13.94)$

   Such reduction shall not exceed the smallest of:

   1. 40 percent for members supporting one floor.
   2. 60 percent for members supporting two or more floors.
   3. R as determined by the following equation:

   $R = 23.1(1 + D/L_o)$ **(Equation 16-9)**

where:

A = Area of floor supported by the member, square feet (m^2).
D = *Dead load* per square foot (m^2) of area supported.
L_o = Unreduced *live load* per square foot (m^2) of area supported.
R = Reduction in percent.

1607.13 Distribution of floor loads. Where uniform floor *live loads* are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full *dead loads* on all spans in combination with the floor *live loads* on spans selected to produce the greatest *load effect* at each location under consideration. Floor *live loads* are permitted to be reduced in accordance with Section 1607.12.

[S] 1607.14 Roof loads. The structural supports of roofs and ((~~*marquees*~~)) *canopies* shall be designed to resist wind and, where applicable, snow and earthquake *loads*, in addition to the *dead load* of construction and the appropriate *live loads* as prescribed in this section. ((~~, or as set forth in Table 1607.1.~~)) The *live loads* acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.14.1 Distribution of roof loads. Where uniform roof live *loads* are reduced to less than 20 psf (0.96 kN/m^2) in accordance with Section 1607.14.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof *live load* shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable *load effect*. See Section 1607.14.2 for reductions in minimum roof *live loads* and Section 7.5 of ASCE 7 for ((~~partial~~)) snow loading.

1607.14.2 Reduction in uniform roof live loads. The minimum uniformly distributed *live loads* of roofs and ((~~*marquees*~~)) *canopies*, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.14.2.1.

1607.14.2.1 Ordinary roofs, awnings and canopies. Ordinary flat, pitched and curved roofs, and *awnings* and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed *roof live load*, L_r, as specified in the following equations or other controlling combinations of *loads* as specified in Section 1605, whichever produces the greater *load effect*.

In structures such as *greenhouses*, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof *load* than specified in the following equations shall not be used

unless *approved* by the *building official*. Such structures shall be designed for a minimum roof live *load* of 12 psf (0.58 kN/m^2).

$L_r = L_o R_1 R_2$ **(Equation 16-10)**

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_o = Unreduced *roof live load* per square foot (m^2) of horizontal projection supported by the member (see Table 1607.1).

L_r = Reduced *roof live load* per square foot (m^2) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

$R_1 = 1$ for $A_t \le 200$ square feet (18.58 m^2) **(Equation 16-11)**

$R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet **(Equation 16-12)**

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t <$ 55.74 square meters

$R_1 = 0.6$ for $A_t \ge 600$ square feet (55.74 m^2) **(Equation 16-13)**

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by the member, and

$R_2 = 1$ for $F \le 4$ **(Equation 16-14)**

$R_2 = 1.2 - 0.05F$ for $4 < F < 12$ **(Equation 16-15)**

$R_2 = 0.6$ for $F \ge 12$ **(Equation 16-16)**

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

[S] 1607.14.2.2 Occupiable roofs. Areas of roofs that are occupiable, such as *vegetative roofs*, landscaped roofs ((~~or for assembly~~)) or other similar purposes, and ((~~*marquees*~~)) *canopies* are permitted to have their uniformly distributed *live loads* reduced in accordance with Section 1607.12.

1607.14.3 Awnings and canopies. *Awnings* and canopies shall be designed for uniform *live loads* as required in Table 1607.1 as well as for snow *loads* and wind *loads* as specified in Sections 1608 and 1609.

1607.14.4 Photovoltaic panel systems. Roof structures that provide support for *photovoltaic panel systems* shall be designed in accordance with Sections 1607.14.4.1 through 1607.14.4.5, as applicable.

1607.14.4.1 Roof live load. Roof structures that support *photovoltaic panel systems* shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof *loads* with the *photovoltaic panel system dead loads*.

   Exception: *Roof live loads* need not be applied to the area covered by *photovoltaic panels* where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.

2. Applicable uniform and concentrated roof loads without the *photovoltaic panel system* present.

1607.14.4.2 Photovoltaic panels or modules. The structure of a roof that supports solar *photovoltaic panels* or modules shall be designed to accommodate the full solar *photovoltaic panels* or modules and ballast *dead load*, including concentrated *loads* from support frames in combination with the *loads* from Section 1607.14.4.1 and other applicable *loads*. Where applicable, snow drift *loads* created by the *photovoltaic panels* or modules shall be included.

1607.14.4.3 Photovoltaic panels installed on open grid roof structures. Structures with open grid framing and without a *roof deck* or sheathing supporting *photovoltaic panel systems* shall be designed to support the uniform and

concentrated *roof live loads* specified in Section 1607.14.4.1, except that the uniform *roof live load* shall be permitted to be reduced to 12 psf (0.57 kN/m^2).

1607.14.4.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic *live load*. Other *loads* and combinations in accordance with Section 1605 shall be accommodated.

1607.14.4.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted *photovoltaic panel systems* shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding.

1607.15 Crane loads. The crane *live load* shall be the rated capacity of the crane. Design *loads* for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel *loads* of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.15.1 Maximum wheel load. The maximum wheel *loads* shall be the wheel *loads* produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting *load effect* is maximum.

1607.15.2 Vertical impact force. The maximum wheel *loads* of the crane shall be increased by the following percentages to account for the effects of vertical impact or vibration:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0 percent

1607.15.3 Lateral force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

1607.15.4 Longitudinal force. The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10 percent of the maximum wheel *loads* of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.16 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the *loads* to which they are subjected but not less than a horizontal *load* of 5 psf (0.240 kN/m^2).

1607.16.1 Fabric partitions. *Fabric partitions* that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following *load* conditions:

1. The horizontal distributed *load* need only be applied to the partition framing. The total area used to determine the distributed *load* shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed *load* shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated *load* of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

((~~**1607.16.2 Fire walls.** In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, *fire walls* and their supports shall be designed to withstand a minimum horizontal allowable stress *load* of 5 psf (0.240 kN/m^2).~~))

1607.17 Fixed ladders. Fixed ladders with rungs shall be designed to resist a single concentrated *load* of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated *load* of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the *stair loads* given in Table 1607.1.

1607.18 Library stack rooms. The live loading indicated in Table 1607.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).
2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607.19 Seating for assembly uses. *Bleachers*, *folding and telescopic seating* and *grandstands* shall be designed for the *loads* specified in ICC 300. Stadiums and arenas with fixed seats shall be designed for the horizontal sway *loads* in Section 1607.19.1.

1607.19.1 Horizontal sway loads. The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.
2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607.20 Sidewalks, vehicular driveways, and yards subject to trucking. The live loading indicated in Table 1607.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

1607.20.1 Uniform loads. In addition to the *loads* indicated in Table 1607.1, other uniform *loads* in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607.20.2 Concentrated loads. The concentrated wheel *load* indicated in Table 1607.1 shall be applied on an area of 4-1/2 inches by 4-1/2 inches (114 mm by 114 mm).

1607.21 Stair treads. The concentrated *load* indicated in Table 1607.1 for *stair* treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This *load* need not be assumed to act concurrently with the uniform *load*.

1607.22 Residential attics. The *live loads* indicated in Table 1607.1 for *attics* in residential occupancies shall comply with the requirements of this section.

1607.22.1 Uninhabitable attics without storage. In residential occupancies, uninhabitable *attic* areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The *live load* in Table 1607.1 need not be assumed to act concurrently with any other *live load* requirement.

1607.22.2 Uninhabitable attics with storage. In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).
2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m^2).

1607.22.3 Attics served by stairs. *Attic* spaces served by *stairways* other than the pull-down type shall be designed to support the minimum *live load* specified for habitable *attics* and sleeping rooms.

SECTION 1608
SNOW LOADS

[S] 1608.1 General. Roofs shall be designed for a uniform snow load of at least 25 psf (1200 Pa). Design snow *loads* shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof *load* shall be not less than that determined by Section 1607.

1608.2 Ground snow loads. The ground snow *loads* to be used in determining the design snow *loads* for roofs shall be determined in accordance with ASCE 7 or Figures 1608.2(1) and 1608.2(2) for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated "CS" in Figures 1608.2(1) and 1608.2(2). Ground snow *loads* for sites at elevations above the limits indicated in Figures 1608.2(1) and 1608.2(2) and for all sites within the CS areas shall be *approved*. Ground snow *load* determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval). Snow loads are zero for Hawaii, except in mountainous regions as *approved* by the *building official*.

TABLE 1609.3.1
WIND SPEED CONVERSIONS[a, b, c]

V	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b. V_{asd} = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

c. V = basic design wind speeds determined from Figures 1609.3(1) through 1609.3(12).

1609.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609.4.1 Wind directions and sectors. For each selected wind direction at which the wind *loads* are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind *loads* shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the following categories, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

[S] 1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

~~((**Exposure B.** For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of not less than 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of not less than 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.~~

~~**Exposure C.** Exposure C shall apply for all cases where Exposure B or D does not apply.~~

~~**Exposure D.** Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the *building height*, whichever is greater, from an Exposure D condition as defined in the previous sentence.~~))

Exposure B. Exposure B shall apply for all cases where Exposure C does not apply.

Exposure C. Exposure C shall apply along the shorelines where the ground surface roughness, as defined by Surface Roughness D, prevails in the following conditions:

1. The upwind direction of the shoreline is exposed to winds coming from the south through west (180 degrees to 270 degrees), and
2. The distance of Surface Roughness D is at least 5,000 feet (1524 m).

Exposure C extends a distance of 600 feet (183 m) from the shoreline as defined in the previous sentence.

Exposure D. Exposure D shall not apply anywhere within the City of Seattle.

Interpretation I1609.4.3: A map of the Exposure C areas is provided at https://www.seattle.gov/sdci/resources/wind-load-factors.

1609.5 Roof systems. Roof systems shall be designed and constructed in accordance with Sections 1609.5.1 through 1609.5.3, as applicable.

SECTION 1612
FLOOD LOADS

1612.1 General. Within *flood hazard areas* as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including *substantial improvement* and restoration of *substantial damage* to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and *flood loads*. For buildings that are located in more than one *flood hazard area*, the provisions associated with the most restrictive *flood hazard area* shall apply.

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

[S] 1612.3 Establishment of flood hazard areas. ((~~To establish *flood hazard areas*, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency in an engineering report entitled "The *Flood Insurance Study* for **[INSERT NAME OF JURISDICTION]**," dated **[INSERT DATE OF ISSUANCE]**, as amended or revised with the accompanying *Flood Insurance Rate Map* (FIRM) and Flood Boundary and *Floodway* Map (FBFM) and related supporting data along with any revisions thereto.~~)) The ((~~adopted~~)) flood hazard maps and supporting data adopted in Seattle Municipal Code Chapter 25 and areas mapped by Seattle Public Utilities are hereby adopted by reference and declared to be part of this section.

1612.3.1 Design flood elevations. Where *design flood elevations* are not included in the *flood hazard areas* established in Section 1612.3, or where *floodways* are not designated, the *building official* is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any *design flood elevation* and *floodway* data available from a federal, state or other source.
2. Determine the *design flood elevation* or *floodway* in accordance with accepted hydrologic and hydraulic engineering practices used to define special *flood hazard areas*. Determinations shall be undertaken by a *registered design professional* who shall document that the technical methods used reflect currently accepted engineering practice.

1612.3.2 Determination of impacts. In riverine *flood hazard areas* where *design flood elevations* are specified but *floodways* have not been designated, the applicant shall provide a *floodway* analysis that demonstrates that the proposed work will not increase the *design flood elevation* more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

[S] 1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a *registered design professional* and submitted to the *building official*:

1. For construction in *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*:
    1.1. The elevation of the *lowest floor*, including the basement, as required by the lowest floor elevation inspection in Section ((~~110.3.3~~)) 108.9.4 and for the final inspection in Section ((~~110.3.12.1~~)) 108.9.9.1.
    1.2. For fully enclosed areas below the *design flood elevation* where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, *construction documents* shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
    1.3. For *dry floodproofed* nonresidential buildings, *construction documents* shall include a statement that the *dry floodproofing* is designed in accordance with ASCE 24 and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.
2. For construction in *coastal high hazard areas* and *coastal A zones*:
    2.1. The elevation of the bottom of the lowest horizontal structural member as required by the *lowest floor* elevation inspection in Section ((~~110.3.3~~)) 108.9.4 and for the final inspection in Section ((~~110.3.12.1~~)) 108.9.9.1.
    2.2. *Construction documents* shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and *flood loads* acting simultaneously on all building components, and other *load* requirements of Chapter 16.
    2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using *allowable stress design*, *construction documents* shall include a statement that the breakaway wall is designed in accordance with ASCE 24.
    2.4 For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

SECTION 1613
EARTHQUAKE LOADS

[S] 1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7 as amended by Section 1613.4, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S, is less than 0.4 g.
2. The *seismic force-resisting system* of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

1613.1.1 Presubmittal conference. At least 60 days prior to submittal of a building permit application that contains the construction documents for any structural component of the building, the applicant shall arrange a presubmittal conference with the structural engineer of record and the *building official* to review the proposed building structural system when an alternate procedure is used under the provisions in Section 104.4 or 104.5. The purpose of the meeting is to obtain conceptual approval from the *building official* of the proposed structural system.

Note: Projects using non-linear response history analysis methods or using an alternative lateral force resisting system are subject to peer review in accordance with Section 1613.4.2, and ASCE 7 Sections 12.2.1.1 and 16.1.1. Peer reviews require lengthy lead time prior to permit application and issuance. Applicants should contact the building official prior to the start of structural design.

1613.2 Seismic ground motion values. Seismic ground motion values shall be determined in accordance with this section.

1613.2.1 Mapped acceleration parameters. The parameters S_S and S_1 shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.2.1(1) through 1613.2.1(10). Where S_1 is less than or equal to 0.04 and S_S is less than or equal to 0.15, the structure is permitted to be assigned *Seismic Design Category* A.

with slopes not more than one unit vertical in 12 units horizontal. Ballasted nonpenetrating systems shall be designed to resist sliding and uplift resulting from lateral and vertical forces as required by Section 1605, using a coefficient of friction determined by acceptable engineering principles. In structures assigned to *Seismic Design Category* C, D, E or F, ballasted nonpenetrating systems shall be designed to accommodate seismic displacement determined by nonlinear response-history or other *approved* analysis or shake-table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for nonstructural components on roofs.

[W] 1613.4 Amendments to ASCE 7. The provisions of Section 1613.4 shall be permitted as an amendment to the relevant provisions of ASCE 7. The text of ASCE 7 shall be amended as indicated in Sections 1613.4.1 through 1613.4.2.

1613.4.1. Modify ASCE 7 Section 12.2.5.4 to read as follows:

12.2.5.4 Increased Structural Height Limit for Steel Eccentrically Braced Frames, Steel Special Concentrically Braced Frames, Steel Buckling-Restrained Braced Frames, Steel Special Plate Shear Walls, and Special Reinforced Concrete Shear Walls. The limits on height, h_n, in Table 12.2-1 are permitted to be increased from 160 ft (50 m) to 240 ft (75 m) for structures assigned to Seismic Design Categories D or E and from 100 ft (30 m) to 160 ft (50 m) for structures assigned to Seismic Design Category F, if all of the following are satisfied:

1. The structure shall not have an extreme torsional irregularity as defined in Table 12.3-1 (horizontal structural irregularity Type 1b).
2. The steel eccentrically braced frames, steel special concentrically braced frames, steel buckling-restrained braced frames, steel special plate shear walls or special reinforced concrete shear walls in any one plane shall resist no more than 60 percent of the total seismic forces in each direction, neglecting accidental torsional effects.
3. Where floor and roof diaphragms transfer forces from the vertical seismic force-resisting elements above the diaphragm to other vertical force-resisting elements below the diaphragm, these in plane transfer forces shall be amplified by the overstrength factor, Ω_o, for the design of the diaphragm flexure, shear, and collectors.
4. The earthquake force demands in foundation mat slabs, grade beams, and pile caps supporting braced frames and/or walls arranged to form a shear-resisting core shall be amplified by 2 for shear and 1.5 for flexure. The redundancy factor, ρ, applies and shall be the same as that used for the structure in accordance with Section 12.3.4.

1613.4.2 ASCE 7 Section 12.6. Amend ASCE 7 Section 12.6 and Table 12.6-1 to read as follows:

12.6 ANALYSIS PROCEDURE SELECTION

12.6.1 Analysis procedure. The structural analysis required by Chapter 12 shall consist of one of the types permitted in Table 12.6-1, based on the structure's seismic design category, structural system, dynamic properties, and regularity, or with the approval of the authority having jurisdiction, an alternative generally accepted procedure is permitted to be used. The analysis procedure selected shall be completed in accordance with the requirements of the corresponding section referenced in Table 12.6-1.

[W][S] Table 12.6-1 Permitted Analytical Procedures				
Seismic Design Category	Structural Characteristics	Equivalent Lateral Force Procedure, Section 12.8[a]	Modal Response Spectrum Analysis, Section 12.9, or Linear Response History Analysis, Section 12.9.2[a]	Nonlinear Response History Procedures, Chapter 16[a]
B, C	All structures	P	P	P
D, E, F	Risk Category I or II buildings not exceeding two *stories* above the base	P	P	P
	Structures of light frame construction	P	P	P
	Structures with no structural irregularities and not exceeding 160 ft in structural height	P	P	P
	Structures exceeding 160 ft in structural height[b] with no structural irregularities and with $T < 3.5T_s$	P	P	P
	Structures not exceeding 160 ft in structural height[b] and having only horizontal irregularities of Type 2, 3, 4, or 5 in Table 12.3-1 or vertical irregularities of Type 4, 5a, or 5b in Table 12.3-2	P	P	P
	All other structures ≤ 240 ft in height[b]	NP	P	P
	All structures > 240 ft in height[b]	NP	NP	P

[a] P: Permitted; NP: Not Permitted; $T_s = S_{D1}/S_{DS}$

[b] The structural height may be increased as allowed under rules promulgated by the building official.

Note: Building designs using non-linear response history procedures must undergo an independent structural review (peer review) in accordance with ASCE 7 Section 16.1.1.

[W] 1613.4.3 ASCE 7 Section 11.2. Amend ASCE 7 Section 11.2 to include the following definition:

USGS SEISMIC DESIGN GEODATABASE: A US Geological Survey (USGS) database of geocoded values of seismic design parameters and geocoded sets of multi-period 5%-damped risk-targeted maximum considered earthquake (MCE_R) response spectra. The parameters obtained from this database may only be used where referenced by Section 11.4.8.1.

Note: The USGS Seismic Design Geodatabase is intended to be accessed through a USGS Seismic Design Web Service that allows the user to specify the site location, by latitude and longitude, and the site class to obtain the seismic design data. The USGS web service spatially interpolates between the gridded data of the USGS *geodatabase*. Both the USGS *geodatabase* and the USGS web service can be accessed at https://doi.org/10.5066/F7NK3C76. The *USGS Seismic Design Geodatabase* is available at the ASCE 7 Hazard Tool https://asce7hazardtool.online/ or an approved equivalent.

[W] 1613.4.4 ASCE 7 Section 11.4.8. Amend ASCE 7 Section 11.4.8 to include the following section:

11.4.8.1 Multi-Period Design Response Spectrum. As an alternative to the ground motion hazard analysis requirements of Section 11.4.8, and suitable for all structures other than those designated Site Class F (unless exempted in accordance with Section 20.3.1), a multi-period design response spectrum may be developed as follows:

1. For exclusive use with the USGS Seismic Design Geodatabase in accordance with this section, the Site Class shall be determined per Section 20.6.
2. Where a multi-period design response spectrum is developed in accordance with this section, the parameters S_{MS}, S_{M1}, S_{DS}, S_{D1}, and T_L as obtained by the USGS Seismic Design Geodatabase shall be used for all applications of these parameters in this standard.
3. The S_S and S_1 parameters obtained by the USGS Seismic Design Geodatabase are only permitted to be used in development of the multi-period design response spectrum and are not permitted to be used in other applications in this standard. The mapped parameters S_S and S_1 as determined by Section 11.4.2 and peak ground acceleration parameter PGA_M as determined by Section 11.8.3 shall be used for all other applications in this standard.
4. At discrete values of period, T, equal to 0.0 s, 0.01 s, 0.02 s, 0.03 s, 0.05 s, 0.075 s, 0.1 s, 0.15 s, 0.2 s, 0.25 s, 0.3 s, 0.4 s, 0.5 s, 0.75 s, 1.0 s, 1.5 s, 2.0 s, 3.0 s, 4.0 s, 5.0 s, 7.5 s, and 10.0 s, the 5%-damped design spectral response acceleration parameter, S_a, shall be taken as 2/3 of the multi-period 5%-damped MCER response spectrum from the USGS Seismic Design Geodatabase for the applicable site class.
5. At each response period, T, less than 10.0 s and not equal to one of the discrete values of period, T, listed in Item 4 above, S_a, shall be determined by linear interpolation between values of S_a, of Item 4 above.

6. At each response period, T, greater than 10.0 s, S_a shall be taken as the value of S_a at the period of 10.0 s, factored by 10/T, where the value of T is less than or equal to that of the long-period transition period, T_L, and shall be taken as the value of S_a at the period of 10.0 s factored by $10T_L/T^2$, where the value of T is greater than that of the long-period transition period, T_L.
7. Where an MCE_R response spectrum is required, it shall be determined by multiplying the multi-period design response spectrum by 1.5.
8. For use with the equivalent lateral force procedure, the spectral acceleration S_a at T shall be permitted to replace S_{D1}/T in Equation (12.8-3) and $S_{D1}/T_L/T^2$ in Equation (12.8-4).

[W] 1613.4.5 ASCE 7 Section 20.6. Amend ASCE 7 Chapter 20 to include the following section:

Section 20.6 Site Classification Procedure For Use With Section 11.4.8.1. For exclusive use in determining the Multi-Period Design Response Spectrum and associated spectral parameters in accordance with Section 11.4.8.1, the Site Class shall be determined in accordance with this section. For all other applications in this standard the Site Class shall be determined per Section 20.1.

[W] 20.6.1 Site Classification

The site soil shall be classified in accordance with Table 20.6-1 and Section 20.6.2 based on the average shear wave velocity parameter, v_s, which is derived from the measured shear wave velocity profile from the ground surface to a depth of 100 ft (30 m). Where shear wave velocity is not measured, appropriate generalized correlations between shear wave velocity and standard penetration test (SPT) blow counts, cone penetration test (CPT) tip resistance, shear strength, or other geotechnical parameters shall be used to obtain an estimated shear wave velocity profile, as described in Section 20.6.3. Where site-specific data (measured shear wave velocities or other geotechnical data that can be used to estimate shear wave velocity) are available only to a maximum depth less than 100 ft (30 m), v_s, shall be estimated as described in Section 20.6.3.

Where the soil properties are not known in sufficient detail to determine the site class, the most critical site conditions of Site Class C, Site Class CD and Site Class D, as defined in Section 20.6.2, shall be used unless the Authority Having Jurisdiction or geotechnical data determine that Site Class DE, E or F soils are present at the site. Site Classes A and B shall not be assigned to a site if there is more than 10 ft (3.1 m) of soil between the rock surface and the bottom of the spread footing or mat foundation.

[W] 20.6.2 Site Class Definitions. Site Class types shall be assigned in accordance with the definitions provided in Table 20.6.2-1 and this section.

20.6.2.1 Soft Clay Site Class E. Where a site does not qualify under the criteria for Site Class F per Section 20.3.1 and there is a total thickness of soft clay greater than 10 ft (3 m), where a soft clay layer is defined by s_u < 500 psf (s_u < 25 kPa), $w \geq 40\%$, and $PI > 20$, it shall be classified as Site Class E. This classification is made regardless of v_s, as computed in Section 20.4.

20.6.2.2 Site Classes C, CD, D, DE and E. The assignment of Site Class C, CD, D, DE, and E soils shall be made based on the average shear wave velocity, which is derived from the site shear wave velocity profile from the ground surface to a depth of 100 ft (30 m), as described in Section 20.4.

20.6.2.3 Site Classes B and BC (Medium Hard and Soft Rock). Site Class B can only be assigned to a site on the basis of shear wave velocity measured on site. If shear wave velocity data are not available and the site condition is estimated by a geotechnical engineer, engineering geologist, or seismologist as Site Class B or BC on the basis of site geology, consisting of competent rock with moderate fracturing and weathering, the site shall be classified as Site Class BC. Softer and more highly fractured and weathered rock shall either be measured on site for shear wave velocity or classified as Site Class C.

20.6.2.4 Site Class A (Hard Rock). The hard rock, Site Class A, category shall be supported by shear wave velocity measurement, either on site or on profiles of the same rock type in the same formation with an equal or greater degree of weathering and fracturing. Where hard rock conditions are known to be continuous to a depth of 100 ft (30 m), surficial shear wave velocity measurements to maximum depths less than 100 ft are permitted to be extrapolated to assess v_s.

TABLE 20.6.2-1
SITE CLASSIFICATION

Site Class	v_s Calculated Using Measured or Estimated Shear Wave Velocity Profile (ft/s)
A. Hard Rock	> 5,000
B. Medium Hard Rock	> 3,000 to 5,000
BC. Soft Rock	> 2,100 to 3,000
C. Very Dense Sand or Hard Clay	> 1,450 to 2,100

TABLE 20.6.2-1
SITE CLASSIFICATION

Site Class	v_s Calculated Using Measured or Estimated Shear Wave Velocity Profile (ft/s)
CD. Dense Sand or Very Stiff Clay	> 1,000 to 1,450
D. Medium Dense Sand or Stiff Clay	> 700 to 1,000
DE. Loose Sand or Medium Stiff Clay	> 500 to 700
E. Very Loose Sand or Soft Clay	≤ 500

[W] 20.6.3 Estimation of Shear Wave Velocity Profiles. Where measured shear wave velocity data are not available, shear wave velocity shall be estimated as a function of depth using correlations with suitable geotechnical parameters, including standard penetration test (SPT) blow counts, shear strength, overburden pressure, void ratio, or cone penetration test (CPT) tip resistance, measured at the site.

Site Class based on estimated values of v_s shall be derived using v_s, $v_s/1.3$, and $1.3v_s$ when correlation models are used to derive shear wave velocities. Where correlations derived for specific local regions can be demonstrated to have greater accuracy, factors less than 1.3 can be used if approved by the Authority Having Jurisdiction. If the different average velocities result in different Site Classes per Table 20.6.2-1, the most critical of the site classes for ground motion analysis at each period shall be used.

Where the available data used to establish the shear wave velocity profile extends to depths less than 100 ft (30 m) but more than 50 ft (15 m), and the site geology is such that soft layers are unlikely to be encountered between 50 and 100 ft, the shear wave velocity of the last layer in the profile shall be extended to 100 ft for the calculation of v_s in Equation (20.4-1). Where the data does not extend to depths of 50 ft (15 m), default site classes, as described in Section 20.6.1, shall be used unless another site class can be justified on the basis of the site geology.

[W] 1613.4.6 ASCE 7 Section 21.3.1. Amend ASCE 7 Section 21.3 to include the following section:

Section 21.3.1 Alternate Minimum Design Spectral Response Accelerations. As an alternate approach to Section 21.3, the lower limit of S_a is permitted to be determined according to this section. The design spectral response acceleration at any period shall not be taken less than 80% of the Multi-Period Design Response Spectrum as determined by Section 11.4.8.1.

For sites classified as Site Class F requiring site-specific analysis in accordance with Section 11.4.8, the design spectral response acceleration at any period shall not be less than 80% of S_a determined for Site Class E.

Exception: Where a different site class can be justified using the site-specific classification procedures in accordance with Section 20.6.2.2, a lower limit of 80% of S_a for the justified site class shall be permitted to be used.

SECTION 1614
ATMOSPHERIC ICE LOADS

1614.1 General. *Ice-sensitive structures* shall be designed for atmospheric ice *loads* in accordance with Chapter 10 of ASCE 7.

SECTION 1615
TSUNAMI LOADS

[W] 1615.1 General. The design and construction of *Risk Category* III and IV buildings and structures located in the *Tsunami Design Zones* defined in the *Tsunami Design Geodatabase* shall be in accordance with Chapter 6 of ASCE 7-22, except as modified by this code. Wherever ASCE 7 is referenced herein, it shall refer to ASCE 7-22, within the extent of ASCE 7 Chapter 6 and WAC 51-50-1615.

Note: The intent of the Washington state amendments to ASCE 7 Chapter 6 (Tsunami Loads and Effects) is to require use of the *Washington Tsunami Design Zone* maps to determine inundation limits, i.e., when a site is within a tsunami design zone. The Washington State Department of Natural Resources has parameters for tsunami inundation depth and flow velocity available for all of Washington's coastal waters and tidally influenced riverine systems (*WA-TDZ*). These parameters are required to be used in lieu of ASCE Tsunami Design Geodatabase, and as a basis for comparison in the probabilistic tsunami hazard analysis in this chapter.

[W] 1615.2 Modifications to ASCE 7. The text of Chapter 6 of ASCE 7 shall be modified as indicated in this section.

1615.2.1 ASCE 7 Section 6.1.1. Replace the third paragraph of ASCE 7 Section 6.1.1 with the following and remove the associated exception:

The Tsunami Design Zone shall be determined using the Washington Tsunami Design Zone maps (WA-TDZ). The WA-TDZ maps are available at https://www.dnr.wa.gov/wa-tdz.

1615.2.2 ASCE 7 Section 6.1.1. Add new fifth paragraph and user note to ASCE 7 Section 6.1.1 to read as follows:

Whenever a Tsunami Design Zone or Fig. 6.1-1 is referenced in ASCE 7 Chapter 6, the WA-TDZ maps shall be used.

1615.2.3 ASCE 7 Section 6.2. Modify ASCE 7 Section 6.2 definitions to read as follows:

ASCE TSUNAMI DESIGN GEODATABASE: Not Adopted.

Note: The ASCE tsunami design geodatabase is not adopted for design purposes in Washington State.

MAXIMUM CONSIDERED TSUNAMI: A probabilistic tsunami having a two percent probability of being exceeded in a 50-year period or a 2,475-year mean recurrence, or a deterministic assessment considering the maximum tsunami that can reasonably be expected to affect a site.

TSUNAMI DESIGN ZONE MAP: The Washington *Tsunami Design Zone maps (WA-TDZ)* designating the potential horizontal inundation limit of the *Maximum Considered Tsunami* found at www.dnr.wa.gov/wa-tdz.

1615.2.4 ASCE 7 Section 6.2. Add new definitions to ASCE 7 Section 6.2 to read as follows:

WASHINGTON TSUNAMI DESIGN ZONE MAP (*WA-TDZ*): The Washington department of natural resources maps of potential tsunami inundation limits for the *Maximum Considered Tsunami*, designated as follows:

[S] Area	Map Number
Columbia River	DOGAMI SP-51 (L1 scenario) adopted by WA DNR
Outer Coast and Strait area	MS 2022-01
Port Townsend	MS 2018-03 (partially superseded by MS 2022-01)
Puget Sound	MS 2021-01 (revised 2022)
San Juan Islands	MS 2016-01 (partially superseded on its eastern edge by MS 2021-01)
Southern Washington Coast	MS 2018-01

The Washington State Department of Natural Resources geodatabase of design parameters for tsunami inundation depth, flow velocity, offshore tsunami amplitude, predominant period, and *tsunami design zone maps* for a *maximum considered tsunami* is available at the Washington TDZ website (https://www.dnr.wa.gov/wa-tdz).

1615.2.5 ASCE 7 Section 6.5.1. Add new second paragraph to ASCE 7 Section 6.5.1 to read as follows:

6.5.1 Tsunami Risk Category II and III buildings and other structures. The *Maximum Considered Tsunami* inundation depth and tsunami flow velocity characteristics at a Tsunami Risk Category II or III building or other structure shall be determined by the *WA-TDZ* maps. Those parameters shall be used as the *Maximum Considered Tsunami* inundation depth and tsunami flow velocity characteristics in lieu of the Energy Grade Line Analysis in Section 6.6.

1615.2.6 ASCE 7 Section 6.5.1.1. Modify the first paragraph of ASCE 7 Section 6.5.1.1 to read as follows:

6.5.1.1 Runup evaluation for areas where no map values are given. For Tsunami Risk Category II and III buildings and other structures where no mapped inundation limit is shown in the *Tsunami Design Zone map*, the ratio of tsunami runup elevation above Mean High Water Level to Offshore Tsunami Amplitude, R/HT, shall be permitted to be determined using the surf similarity parameter $\xi 100$, according to Eqs. (6.5-2a, b, c, d, or e) and Fig. 6.5-1.

1615.2.7 ASCE 7 Section 6.5.2. Modify the paragraph and the exception, to read as follows:

6.5.2 Tsunami Risk Category IV buildings and other structures. A site-specific Probabilistic Tsunami Hazard Analysis (PTHA) shall be performed for Tsunami Risk Category IV buildings and other structures. Site-specific velocities determined by site-specific PTHA determined to be less than the design flow velocities determined from the *WA-TDZ* maps shall be subject to the limitation in Section 6.7.6.8. Site-specific velocities determined to be greater than the *WA-TDZ* map velocities shall be used. EXCEPTION: For structures other than Tsunami Vertical Evacuation Refuge Structures, a site-specific Probabilistic Tsunami Hazard Analysis need not be performed where the inundation depth determined from the *WA-TDZ* maps is determined to be less than 12 ft (3.66 m) at any point within the location of the Tsunami Risk Category IV structure.

1615.2.8 ASCE 7 Section 6.6.1. Replace ASCE 7 Section 6.6.1 to read as follows:

6.6.1 Maximum inundation depth and flow velocities. The maximum inundation depths and flow velocities associated with the stages of tsunami flooding are determined by the *WA-TDZ* maps. Flow velocity for design purposes shall not be taken as less than 10 ft/s (3.0 m/s) and need not be taken as greater than the lesser of 1.5(ghmax) 1/2 and 50 ft/s (15.2 m/s).

1615.2.9 ASCE 7 Section 6.7. Replace ASCE 7 Section 6.7 with the following and add a user note:

When required by Section 6.5, the inundation depths and flow velocities shall be determined by site-specific inundation studies complying with the requirements of this section. Site-specific analyses shall use an integrated generation, propagation, and inundation model that replicates the given offshore tsunami waveform amplitude and period from the seismic sources given in Section 6.7.2.

1615.2.10 ASCE 7 Table 6.7-2. Modify ASCE 7 Table 6.7-2 to read as follows:

TABLE 6.7-2
MAXIMUM MOMENT MAGNITUDE

Subduction Zone	Moment Magnitude M_{Wmax}
Alaskan-Aleutian	9.2
Cascadia	9.0
Chile-Peru	9.5
Izu-Bonin-Mariana	9.0
Kamchatka-Kurile and Japan Trench	9.4

1615.2.11 ASCE 7 Section 6.7.5.1. Modify ASCE 7 Section 6.7.5.1 Item 4, Item 5, and Item 6 to read as follows:

6.7.5.1 Offshore tsunami amplitude for distant seismic sources. Offshore tsunami amplitude shall be probabilistically determined in accordance with the following:

4. The extent of offshore tsunami amplitude points considered for the site shall include the following:
   (a) For outer coast sites, the extent shall include points within at least 40 mi (64.4 km) but not exceeding 50 mi (80.5 km) of projected length along the coastline, centered on the site within a tolerance of plus or minus 6 mi (9.7 km);
   (b) Reserved;
   (c) For sites within bays or inland waterways (such as the Strait of Juan de Fuca), the designated center of the computed offshore tsunami amplitude points shall be taken offshore of the mouth of the bay or waterway centered in accordance with criteria (a) above;
   (d) For island locations where the projected width of the island is less than 40 mi (64.4 km), it shall be permitted to consider the extent of offshore tsunami amplitude points corresponding to the projected width of the island. Shorter extents of offshore tsunami amplitude points shall be permitted for island locations, but shall not be less than 10 mi (16.1 km);
   (e) In addition to the above, the tsunami source development and inundation modeling are subject to an independent peer review by a tsunami modeler approved by the Authority Having Jurisdiction, who shall present a written report to the Authority Having Jurisdiction as to the hazard consistency of the modeling with the requirements of Section 6.7.
5. The mean value of the computed offshore tsunami wave amplitudes shall be not less than 100 percent of the mean value for the coinciding offshore tsunami amplitude data given by the *WA-TDZ* maps.
6. The individual values of the computed offshore tsunami wave amplitude shall be not less than 80 percent of the coinciding offshore tsunami amplitude values given by the *WA-TDZ* maps.

1615.2.12 ASCE 7 Section 6.7.5.3. Modify ASCE 7 Section 6.7.5.3.1(b) and (c) to read as follows:

(b) The mean value of the computed offshore tsunami amplitudes is at least 85 percent of the mean value for the coinciding offshore tsunami amplitude data of the *WA-TDZ* maps.

(c) The values of the computed offshore tsunami wave amplitude are not less than 75 percent of the coinciding offshore tsunami amplitude values of the *WA-TDZ* maps.

1615.2.13 ASCE 7 Section 6.7.6.2. Modify ASCE 7 Section 6.7.6.2 and add a user note to read as follows:

6.7.6.2 Seismic subsidence before tsunami arrival. Where the seismic source is a local earthquake event, the *Maximum Considered Tsunami* inundation shall be determined for an overall elevation subsidence value directly computed for the seismic source mechanism.

1615.2.14 ASCE 7 Figure 6.7-3. Remove Figure 6.7-3 and the associated note.

Note: WA-TDZ maps include computed subsidence and uplift (where applicable) in the inundation results. See https://www.dnr.wa.gov/wa-tdz.

1615.2.15 ASCE 7 Section 6.8.9. Modify the first sentence of ASCE 7 Section 6.8.9 to read as follows:

6.8.9 Seismic effects on the foundations preceding *maximum considered tsunami.* Where designated in the *Tsunami Design Zone map* as a site subject to a tsunami from a local earthquake, the structure shall be designed for the preceding coseismic effects.

SECTION 1616
STRUCTURAL INTEGRITY

1616.1 General. *High-rise buildings* that are assigned to *Risk Category* III or IV shall comply with the requirements of Section 1616.2 if they are frame structures, or Section 1616.3 if they are *bearing wall structures*.

1616.2 Frame structures. *Frame structures* shall comply with the requirements of this section.

1616.2.1 Concrete frame structures. *Frame structures* constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two *orthogonal* directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete *frame structures*. *Frame structures* constructed with a structural steel frame or a frame composed of open web *steel joists*, joist girders with or without other *structural steel elements* or a frame composed of composite steel or composite *steel joists* and reinforced concrete elements shall conform to the requirements of this section.

1616.2.2.1 Columns. Each column splice shall have the minimum *design strength* in tension to transfer the design dead and *live load* tributary to the column between the splice and the splice or base immediately below.

1616.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for *allowable stress design* (ASD) or two-thirds of the required shear strength for *load and resistance factor* design (*LRFD*) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than 3/8-inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two *orthogonal* directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for *LRFD*, but not less than 10 kips (45 kN).

1616.3 Bearing wall structures. *Bearing wall structures* shall have vertical ties in all *load-bearing walls* and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616.3.

CHAPTER 17

SPECIAL INSPECTIONS AND TESTS

User notes:

About this chapter: *Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, and labeling materials and assemblies. Its key purposes are to establish where additional inspections/observations and testing must be provided, and the submittals and verifications that must be provided to the building official. This chapter expands on the inspections of Chapter 1 by requiring special inspection by a qualified individual where indicated and, in some cases, structural observation by a registered design professional. Quality assurance measures that verify proper assembly of structural components and the suitability of the installed materials are intended to provide a building that, once constructed, complies with the minimum structural and fire-resistance code requirements as well as the approved design. To determine this compliance often requires frequent inspections and testing at specific stages of construction.*

Code development reminder: *Code change proposals to sections preceded by the designation [BF] will be considered by the IBC—Fire Safety Code Development Committee during the 2021 (Group A) Code Development Cycle. Sections preceded by the designation [F] will be considered by the International Fire Code Development Committee during the 2021 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the Group B cycle.*

SECTION 1701
GENERAL

1701.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

SECTION 1702
NEW MATERIALS

1702.1 General. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

SECTION 1703
APPROVALS

[S] 1703.1 Approved agency. Whenever tests or certification of any material or fabricated assembly are required by this code, the tests or certification shall be made by an agency approved by the *building official* to conduct the tests or provide the certification. The *building official* is authorized to establish rules and regulations setting forth conditions and provisions for approval of agencies and for the conduct of any agency so approved. An approved agency shall provide all information as necessary for the *building official* to determine that the agency meets the applicable requirements specified in Sections 1703.1.1 through 1703.1.3. The *building official* is authorized to suspend or revoke approval of an agency upon evidence of failure of the agency to properly conduct any test, certify any material, or to perform any inspection in a manner required by this code.

1703.1.1 Independence. An *approved agency* shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall disclose to the *building official* and the *registered design professional in responsible charge* possible conflicts of interest so that objectivity can be confirmed.

1703.1.2 Equipment. An *approved agency* shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

1703.1.3 Personnel. An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests and *special inspections*. Unless otherwise *approved* by the *building official*, all *special inspectors* shall be registered with the Washington Association of Building Officials. A registered civil or structural engineer or registered architect is permitted to serve as a *special inspector* when approved by the *building official*.

1703.1.4 Approval of tests and inspections. *Special inspectors* and inspection and testing agencies shall not conduct any inspections or tests until the *building official* has authorized the inspection or test in writing. The *special inspectors* or inspection/testing agency approved by the *building official* shall not be changed without obtaining prior approval of the *registered design professional in responsible charge* or the owner, and the *building official*.

((~~**1703.2 Written approval.** Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be *approved* in writing after satisfactory completion of the required tests and submission of required test reports.~~

~~**1703.3 Record of approval.** For any material, appliance, equipment, system or method of construction that has been *approved*, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the *building official*'s office and shall be available for public review at appropriate times.~~))

1703.4 Performance. Specific information consisting of test reports conducted by an *approved agency* in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the *building official* to determine that the product, material or assembly meets the applicable code requirements.

[S] 1703.4.1 Research and investigation. ((~~Sufficient~~)) If *approved* by the *building official*, technical data shall be submitted to the *building official* to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the *building official* shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

1703.4.2 Research reports. Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

1703.5 Labeling. Products, materials or assemblies required to be *labeled* shall be *labeled* in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.4.

1703.5.1 Testing. An *approved agency* shall test a representative sample of the product, material or assembly being *labeled* to the relevant standard or standards. The *approved agency* shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703.5.2 Inspection and identification. The *approved agency* shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be *labeled*. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

1703.5.3 Label information. The *label* shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the *approved agency*'s identification.

1703.5.4 Method of labeling. Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the *building official* to determine conformance to this code. Such a report shall be *approved* by the *building official*.

1703.6.1 Follow-up inspection. The owner or the owner's authorized agent shall provide for *special inspections* of *fabricated items* in accordance with Section 1704.2.5.

1703.6.2 Test and inspection records. Copies of necessary test and *special inspection* records shall be filed with the *building official*.

[S] 1703.7 Preconstruction conference. For projects requiring *special inspection*, the owner or the owner's agent shall arrange a conference with the project contractor, the design team, the *special inspection* agency and the *building official* prior to commencing work on any portion of construction requiring *special inspection*. The purpose of the conference is to identify and clarify the *special inspection* requirements of the project.

[S] 1703.8 Revocation of registration or approval to inspect. The *building official* is authorized to revoke, suspend or refuse to renew registration or approval of inspection agencies, *special inspectors* and nonregistered *special inspectors*, including inspectors registered by the Washington Association of Building Officials. This may be done upon evidence submitted to the *building official* of incompetence, of willful or negligent failure to observe or report violations of the *Seattle Building Code* or of any other failure to perform properly and effectively the duties required by this code or other duties assumed by an inspection agency or nonregistered *special inspector*. The inspection agency or *special inspector* shall be notified in writing of the *building official's* decision to revoke, suspend or refuse to renew registration or approval. The notice shall be served in the manner set forth in RCW 4.28.080 for service of a summons or sent by first class mail. For purposes of this section, service is complete at the time of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or City holiday, the period runs until 5 p.m. on the next business day.

1703.8.1 Review by the building official for revocation of registration. Any *person* aggrieved by a notice of revocation issued pursuant to Section 1703.8 may obtain a review of the notice by making a request in writing to the *building official* within three business days of the date of service of the notice of revocation.

1703.8.1.1 Review procedure. The review shall occur within five business days after receipt by the *building official* of the request for review unless otherwise agreed by the *person* requesting the review. Any *person* aggrieved by or interested in the notice of revocation may submit additional information to the *building official* for consideration as part of the review at any time prior to the review. The review will be made by a representative of the *building official* who will review all additional information received and may also request a site visit.

1703.8.1.2 Decision. After the review, the *building official* shall:

1. Sustain the notice of revocation and set or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Continue the review to a date certain; or
4. Modify the notice of revocation and set or modify the date the revocation will take effect.

1703.8.1.3 Order. The *building official* shall issue an order containing the decision within ten days after the review is completed and shall cause the order to be sent by regular first class mail to the *persons* requesting the review, any other *person* on whom the notice of revocation was served and any other *person* who requested a copy before issuance of the order of the *building official*. The order of the *building official* is the final order of the City and all parties are bound by the final order.

SECTION 1704
SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

1704.1 General. *Special inspections* and tests, statements of *special inspections*, responsibilities of contractors, submittals to the *building official* and *structural observations* shall meet the applicable requirements of this section.

[S] 1704.2 Special inspections and tests. Where application is made to the *building official* for construction as specified in Section ((~~105~~)) 106, the owner or the owner's authorized agent, other than the contractor, shall employ one or more *approved agencies* to provide *special inspections* and tests during construction on the types of work specified in Section 1705 and identify the *approved agencies* to the *building official*. The *building official* may require additional *special inspectors* if the *building official* determines they are needed due to the magnitude or complexity of the job. These *special inspections* and tests are in addition to the inspections by the *building official* that are identified in Section ((~~110~~)) 108.

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as *approved* by the *building official*.
2. Unless otherwise required by the *building official*, *special inspections* and tests are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.
3. *Special inspections* and tests are not required for portions of structures designed and constructed in accordance with the cold-formed steel *light-frame construction* provisions of Section 2211.1.2 or the *conventional light-frame construction* provisions of Section 2308.
4. The contractor is permitted to employ the *approved agencies* where the contractor is also the owner.

1704.2.1 Special inspector qualifications. Prior to the start of the construction, the *approved agencies* shall provide written documentation to the *building official* demonstrating the competence and relevant experience or training of the *special inspectors* who will perform the *special inspections* and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of *special inspection* or testing activities for projects of similar complexity and material qualities. Unless otherwise *approved* by the *building official*, all *special inspectors* shall be registered with the Washington Association of Building Officials. These qualifications are in addition to qualifications specified in other sections of this code.

The *registered design professional in responsible charge* and engineers of record involved in the design of the project are permitted to act as an *approved agency* and their personnel are permitted to act as *special inspectors* for the work designed by them, provided they qualify as *special inspectors*.

1704.2.1.1 Registration of special inspectors.

1704.2.1.1.1 Application for registration. Criteria for registration of *special inspectors* shall be established by the *building official* by rule.

1704.2.1.1.2 Issuance of certificate of registration. If the *building official* is satisfied that the applicant is qualified, a Certificate of Registration or a Limited Certificate of Registration shall be issued that specifies the types of inspection the applicant has been authorized to perform. Valid registration from the Washington Association of Building Officials is permitted to substitute for registration by the *building official*.

1704.2.1.1.3 Renewal of special inspector's registration. A Certificate of Registration or Limited Certificate of Registration is valid for the period of time to be determined by the *building official* by rule. Upon application for renewal of a Certificate of Registration, the *building official* is permitted to re-examine the applicant to ascertain his/her fitness to perform the inspection of the type or types for which the application was made.

1704.2.1.1.4 Revocation. *Special inspectors'* certifications are subject to revocation according to Section 1703.8.

1704.2.2 Access for special inspection. ((~~The~~)) It is the duty of the *person* requesting *special inspections* to provide that construction or work for which *special inspection* or testing is required ((~~shall remain~~)) is accessible and exposed for *special inspection* or testing purposes until completion of the required *special inspections* or tests.

1704.2.3 Statement of special inspections. The applicant shall submit a statement of *special inspections* ((~~in accordance with Section 107.1~~)) as a condition for permit issuance. This statement shall be in accordance with Section 1704.3.

Exception: A statement of *special inspections* is not required for portions of structures designed and constructed in accordance with the cold-formed steel *light-frame construction* provisions of Section 2211.1.2 or the *conventional light-frame construction* provisions of Section 2308.

((~~**1704.2.4 Report requirement.** *Approved agencies* shall keep records of *special inspections* and tests. The *approved agency* shall submit reports of *special inspections* and tests to the *building official* and to the *registered design professional in responsible charge*. Reports shall indicate that work inspected or tested was or was not completed in conformance to *approved construction documents*. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the *building official* and to the *registered design professional in responsible charge* prior to the completion of that phase of the work. A final report documenting required *special inspections* and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the *building official*.~~))

1704.2.4 Responsibilities.

1704.2.4.1 Responsibilities of special inspector. The *special inspector* is responsible for conducting all *special inspections* for which the *special inspector* was employed and notified and for carrying out the duties of a *special inspector* as specified in Section 1704.

1704.2.4.1.1 Specific duties. Registered *special inspectors* are regularly authorized deputies of the *building official* and are subject to all duties imposed by the *building official*, in addition to the following:

1. The registered *special inspector* shall be present during the execution of all assigned work. The registered *special inspector* shall report to the job sufficiently in advance of construction to become familiar with the plans and to inspect all materials to be used or concealed within the work. The *special inspector* shall inspect the construction, erection, placing, or other use of materials; and shall observe whether there is compliance with the *approved* design as to all of the foregoing. During the execution of all assigned work, the registered *special inspector* shall not undertake or engage in any other task or occupation that interferes with the proper performance of the inspection duties.
2. The registered *special inspector* shall not approve the placing of foundation concrete or pile caps prior to the approval of the soil condition or pile driving reports by the engineer who performed the *special inspection* for the pile installation.
3. The registered *special inspector* shall be employed only by an *approved* inspection or testing agency.
4. The registered *special inspector* shall not inspect work performed, or material supplied, by any contractor, subcontractor or material vendor with whom the inspector is employed.
5. If any registered *special inspector* is negligent in the performance of the inspector's duties, the *building official* is permitted to stop the work.

1704.2.4.1.2 Daily reports. The registered *special inspector* shall immediately report all irregularities, substitution of materials and violations to the contractor for correction, then if uncorrected, to the *registered design professional in responsible charge* and to the *building official*. At the conclusion of each inspection, the registered *special inspector* shall submit a report to the *registered design professional in responsible charge* and owner relative to the portion of the work inspected, stating whether the work requiring *special inspection* was, to the best of the *special inspector's* knowledge, in conformance with the *approved* plans and specifications and the applicable workmanship provisions of this code and related standards. The report shall be signed by the registered *special inspector*. One copy of the report shall be submitted to the *building official* by the *approved* inspection or testing agency no later than one week

from the date of the inspection and shall be filed in the records of the agency's office. One copy of the report shall be left at the job site by the *special inspector*. The *special inspector* shall also provide, as directed by the *building official* or by the *registered design professional in responsible charge* or owner, such other information as is required during the *special inspector's* assigned employment.

1704.2.4.1.3 Final report. The inspection or testing agency shall submit a final signed report listing the scope of required inspection and stating whether all work requiring *special inspection* was, to the best of the agency's knowledge, inspected and reported as specified on *construction documents*.

1704.2.4.2 Responsibility of owner. The owner or an authorized agent is responsible for notifying the *special inspector* when construction activity is scheduled that requires *special inspection*. If the owner designates another *person* to notify the *special inspector*, the owner retains the responsibility to assure that the *special inspections* are conducted and required reports submitted to the *building official.* The *approved* testing agency shall notify the *building official* and the *registered design professional in responsible charge* or owner of the commencement of inspection of a job and shall specify the type of inspection for which the special inspector has been engaged. This notification shall be made prior to commencement of inspection. The *approved* testing agency shall notify the *building official* prior to commencement of each day's inspection thereafter. The *building official* is permitted to require that every request for *special inspection* be filed at least one working day before the *special inspection* is desired. The request shall be made in writing or by telephone at the option of the *building official*.

1704.2.4.3 Posting special inspection record. The *building official* is permitted to require that work requiring *special inspection* not be commenced until the permit holder or the permit holder's agent posts an inspection log in a conspicuous place on the premises. The record shall be posted in a position which allows the *special inspector* to conveniently enter his/her identification, the date, and type of inspection performed. This record shall be maintained there by the permit holder until final approval has been granted by the *building official*.

1704.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, *special inspections* of the *fabricated items* shall be performed during fabrication, except where the fabricator has been *approved* to perform work without *special inspections* in accordance with Section 1704.2.5.1. *Special inspections* are not required for steel members and assemblies produced by fabricators that are registered in the Washington Association of Building Officials (WABO) Steel Fabricator Registration Program.

Note: The City of Seattle does not register fabricators for products that are within the scope of the WABO registration program.

1704.2.5.1 Fabricator approval. *Special inspections* during fabrication are not required where the work is done on the premises of a fabricator *approved* according to the provisions of this chapter to perform such work without *special inspection*. ((~~Approval shall be based on review of the fabricator's written fabrication procedures and quality control manuals that provide a basis for control of materials and workmanship, with periodic auditing of fabrication and quality control practices by an *approved agency* or the *building official*. At completion of fabrication, the *approved fabricator* shall submit a *certificate of compliance* to the owner or the owner's authorized agent for submittal to the *building official* as specified in Section 1704.5 stating that the work was performed in accordance with the *approved construction documents*.~~))

1704.2.5.1.1 Application for registration. Application for registration as an *approved* fabricator shall be made to the *building official* by plants engaged in the manufacture of:

1. Prestressed or precast concrete structural products, and premixed concrete.
2. Unit masonry products.
3. Engineered wood products.
4. Prefabricated or assembly-line-produced metal products.
5. Other prefabricated products as the *building official* designates.

1704.2.5.1.2 Requirements for registration. The *building official* is authorized to examine manufacturing plants that submit applications for registration and shall issue certificates of registration if the plants have complied with the following requirements:

1. Develop and submit a detailed fabrication procedural manual reflecting key quality control procedures that will provide a basis for inspection control of the fabricating process.
2. Have the fabricator's quality control capabilities, operation of equipment and personnel as outlined in the fabrication procedural manual verified by an *approved* inspection or quality control agency.

3. Agree to have periodic plant inspections conducted by an approved inspection or quality control agency to monitor the effectiveness of the quality control program and to allow unannounced audits of the plant by the *building official*.
4. Agree to require the inspection or quality control agency to notify the *building official* in writing of any changes to the procedural manual.
5. Agree to submit a Certificate of Compliance, if required by the *building official*, that work was performed in accordance with the *approved* plans and specifications to the *building official* and to the *registered design professional in responsible charge*.
6. Pay a registration fee determined by the *building official* in accordance with provisions of the *Fee Subtitle*.

1704.2.5.1.3 Review by the building official for denial of registration of fabricators. The fabricator may request in writing a review before the *building official* to reconsider the decision to deny registration. The request shall be filed in writing with the *building official*.

1704.2.5.1.3.1 Review procedure. The review shall occur no later than 15 working days from receipt of the written request unless otherwise agreed by the *person* requesting the review. Any *person* affected by the decision to deny registration may submit additional information to the *building official* for consideration as part of the review at any time prior to the review. The review will be made by a representative of the *building official* who will review all additional information received. The reviewer may request clarification of the information and a site visit.

1704.2.5.1.3.2 Decision. After the review, the *building official* shall:

1. Sustain the denial of registration;
2. Withdraw the denial of registration;
3. Modify the decision to deny registration; or
4. Continue the review to a date certain.

1704.2.5.1.3.3 Order. The *building official* shall issue an order within ten days after the review is completed and shall send it by regular first class mail to the *person* or *persons* requesting the review and any other *person* who requested a copy.

1704.2.5.1.4 Renewal of registration. Registration of *approved* fabricators is valid for one year from the date of issuance and is subject to renewal annually. Registration may be renewed upon application, contingent on compliance with quality control procedures during the past year and payment of a fee in accordance with provisions of the *Fee Subtitle*. The *building official* is authorized to revoke registration for cause.

1704.2.5.1.5 Fees. Fees for examination and registration of *special inspectors* are determined by the *building official* in accordance with the *Fee Subtitle*.

1704.3 Statement of special inspections. Where *special inspections* or tests are required by Section 1705, the *registered design professional in responsible charge* shall prepare a statement of *special inspections* in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of *special inspections* is permitted to be prepared by a qualified person *approved* by the *building official* for construction not designed by a *registered design professional*.

[S] 1704.3.1 Content of statement of special inspections. The statement of *special inspections* shall identify the following:

1. The materials, systems, components and work required to have *special inspections* or tests by the *building official* or by the *registered design professional* responsible for each portion of the work.
2. The type and extent of each *special inspection*, if required by the *building official*.
3. The type and extent of each test, if required by the *building official*.
4. Additional requirements for *special inspections* or tests for seismic or wind resistance as specified in Sections 1705.12, 1705.13 and 1705.14.
5. For each type of *special inspection*, identification as to whether it will be continuous *special inspection*, periodic *special inspection* or performed in accordance with the notation used in the referenced standard where the inspections are defined.

1704.3.2 Seismic requirements in the statement of special inspections. Where Section 1705.13 or 1705.14 specifies *special inspections* or tests for seismic resistance, the statement of *special inspections* shall identify the *designated seismic systems* and *seismic force-resisting systems* that are subject to the *special inspections* or tests.

1704.3.3 Wind requirements in the statement of special inspections. Where Section 1705.12 specifies *special inspection* for wind resistance, the statement of *special inspections* shall identify the *main windforce-resisting systems* and wind-resisting components that are subject to *special inspections*.

[S] ((~~1704.4 Contractor responsibility.~~ ~~Each contractor responsible for the construction of a main wind- or *seismic force-resisting system*, *designated seismic system* or a wind- or seismic force-resisting component listed in the statement of *special inspections* shall submit a written statement of responsibility to the *building official* and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of *special inspections*.~~))

1704.5 Submittals to the building official. In addition to the submittal of reports of *special inspections* and tests in accordance with Section 1704.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the *building official* for each of the following:

1. *Certificates of compliance* for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of an *approved fabricator* in accordance with Section 1704.2.5.1.
2. *Certificates of compliance* for the seismic qualification of nonstructural components, supports and attachments in accordance with Section 1705.14.2.
3. *Certificates of compliance* for *designated seismic systems* in accordance with Section 1705.14.3.
4. Reports of preconstruction tests for shotcrete in accordance with ACI 318.
5. *Certificates of compliance* for open web *steel joists* and joist girders in accordance with Section 2207.5.
6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of *seismic force-resisting systems* in structures assigned to *Seismic Design Category* B, C, D, E or F.

[S] 1704.6 Structural observations. Where required by the provisions of Section 1704.6.1, the owner or the owner's authorized agent shall employ a *registered design professional* to perform *structural observations*. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. *Structural observation* does not include or waive the responsibility for the inspections in Section ((~~110~~)) 108 or the *special inspections* in Section 1705 or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the *building official* a written statement identifying the frequency and extent of *structural observations*. At the conclusion of the work included in the permit, the structural observer shall submit to the *building official* a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

1704.6.1 Structural observations for structures. *Structural observations* shall be provided for those structures where one or more of the following conditions exist:

1. The structure is classified as *Risk Category III or* IV.
2. The structure is a *high-rise building*.
3. The structure is assigned to *Seismic Design Category* E, and is greater than two stories above the grade plane.
4. The structure includes five *stories* of wood-frame construction.

((~~4~~)) 5. Such observation is required by the *registered design professional* responsible for the structural design.

((~~5~~)) 6. Such observation is specifically required by the *building official*.

SECTION 1705
REQUIRED SPECIAL INSPECTIONS AND TESTS

1705.1 General. *Special inspections* and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705.1.1 Special cases. *Special inspections* and tests shall be required for proposed work that is, in the opinion of the *building official*, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.

3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

[S] 1705.2 Steel construction. The *special inspections* and nondestructive testing of steel construction in buildings, structures, and portions thereof shall be in accordance with this section.

Exception: *Special inspections* of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. ((~~In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the *approved construction documents*.~~))

1705.2.1 Structural steel. *Special inspections* and nondestructive testing of *structural steel elements* in buildings, structures and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 360.

Exception: *Special inspection* of railing systems composed of *structural steel elements* shall be limited to welding inspection of welds at the base of cantilevered rail posts.

1705.2.2 Cold-formed steel deck. *Special inspections* and qualification of welding *special inspectors* for cold-formed steel floor and *roof deck* shall be in accordance with the quality assurance inspection requirements of SDI QA/QC.

1705.2.3 Open-web steel joists and joist girders. *Special inspections* of open-web *steel joists* and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705.2.3.

TABLE 1705.2.3
REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]
1. Installation of open-web steel joists and joist girders.			
a. End connections – welding or bolted.	—	X	SJI specifications listed in Section 2207.1.
b. Bridging – horizontal or diagonal.	—	—	—
1. Standard bridging.	—	X	SJI specifications listed in Section 2207.1.
2. Bridging that differs from the SJI specifications listed in Section 2207.1.	—	X	—

For SI: 1 inch = 25.4 mm.
a. Where applicable, see Section 1705.13.

1705.2.4 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the *special inspector* shall verify that the temporary installation restraint/bracing and the permanent *individual truss member* restraint/bracing are installed in accordance with the *approved* truss submittal package.

1705.3 Concrete construction. *Special inspections* and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.

Exceptions: *Special inspections* and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above *grade plane* that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above *grade plane* that are fully supported on earth or rock where:
   2.1. The footings support walls of *light-frame construction*.
   2.2. The footings are designed in accordance with Table 1809.7.
   2.3. The structural design of the footing is based on a specified compressive strength, f'_c, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the *approved construction documents* or used in the footing construction.
3. *Nonstructural concrete* slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

[S] TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	IBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	—
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum 5/16″; and c. Inspect all other welds.	— — X	X X —	AWS D1.4 ACI 318: 26.6.4	—
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X —	— X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172 ACI 318: 26.5, 26.12	—
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	—
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	—
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X	— —	ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for: a. Installation of the embedded parts b. Completion of the continuity of reinforcement across joints. c. Completion of connections in the field.	 X X X	 — — —	ACI 318: 26.13.1.3 ACI 550.5	—
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
14. Inspect formwork for <u>general conformity to approved plans for size and</u> shape ((~~, location and dimensions~~)) of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.13.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

1705.3.1 Welding of reinforcing bars. *Special inspections* of welding and qualifications of *special inspectors* for reinforcing bars shall be in accordance with the requirements of AWS D1.4 for *special inspection* and of AWS D1.4 for *special inspector* qualification.

1705.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the *building official* shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

[S] 1705.3.3 Inspection during concrete mixing. *Special inspections* are required during mixing of concrete under one of the following circumstances:

1. Concrete mixes prepared in a batch plant that is not certified by The City of Seattle;
2. All structural lightweight concrete mixes;
3. Concrete mixes with f'_c greater than 6000 psi (41.4 Mpa);
4. Concrete mixes containing alternative materials addressed in Section 1705.3.2; or
5. Other unusual circumstances as determined by the *building official.*

Exception: Inspection during the mixing of concrete is not required if the proportions of ingredients are established in accordance with Table 1905.1.10 or if a mix has been granted continuous approval by the *building official*.

1705.4 Masonry construction. *Special inspections* and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

Exception: *Special inspections* and tests shall not be required for:

1. Empirically designed masonry, *glass unit masonry* or masonry *veneer* designed in accordance with Section 2109, Section 2110 or Chapter 14, respectively, where they are part of a structure classified as *Risk Category* I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

1705.4.1 Glass unit masonry and masonry veneer in Risk Category IV. *Special inspections* and tests for glass unit masonry or masonry *veneer* designed in accordance with Section 2110 or Chapter 14, respectively, where they are part of a structure classified as *Risk Category* IV shall be performed in accordance with TMS 602 Level 2.

1705.4.2 Vertical masonry foundation elements. *Special inspections* and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705.4.

1705.5 Wood construction. *Special inspections* of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. *Special inspections* of site-built assemblies shall be in accordance with this section.

1705.5.1 High-load diaphragms. High-load *diaphragms* designed in accordance with Section 2306.2 shall be installed with *special inspections* as indicated in Section 1704.2. The *special inspector* shall inspect the *wood structural panel* sheathing to ascertain whether it is of the grade and thickness shown on the *approved* construction documents. Additionally, the *special inspector* must verify the *nominal size* of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the *approved construction documents*.

[S] 1705.5.2 Metal-plate-connected wood trusses. Special inspections of wood trusses with overall heights of 60 inches (1524 mm) or greater shall be performed to verify that the installation of the permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package. For wood trusses with a clear span of 60 feet (18 288 mm) or greater, the special inspector shall verify during construction that the temporary installation restraint/bracing is installed in accordance with the approved truss submittal package.

[S] ((~~1705.5.2~~)) 1705.5.3 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the *special inspector* shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

((~~1705.5.3~~)) 1705.5.4 Mass timber construction. *Special inspections* of *mass timber* elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table ((~~1705.5.3~~)) 1705.5.4.

TABLE ((~~1705.5.3~~)) 1705.5.4
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION

TYPE		CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2.	Inspect erection of mass timber construction.	—	X

1. The structure consists of *light-frame construction*; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.2.4, does not exceed 0.5; and the *building height* of the structure does not exceed 35 feet (10 668 mm).
2. The *seismic force-resisting system* of the structure consists of *reinforced masonry* or reinforced concrete; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.2.4, does not exceed 0.5; and the *building height* of the structure does not exceed 25 feet (7620 mm).
3. The structure is a detached one- or two-family dwelling not exceeding two *stories above grade plane* and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7:
   3.1. Torsional or extreme torsional irregularity.
   3.2. Nonparallel systems irregularity.
   3.3. Stiffness-soft story or stiffness-extreme soft story irregularity.
   3.4. Discontinuity in lateral strength-weak story irregularity.

1705.13.1 Structural steel. *Special inspections* for seismic resistance shall be in accordance with Section 1705.13.1.1 or 1705.13.1.2, as applicable.

1705.13.1.1 Seismic force-resisting systems. *Special inspections* of structural steel in the *seismic force-resisting systems* in buildings and structures assigned to *Seismic Design Category* B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

Exceptions:

1. In buildings and structures assigned to *Seismic Design Category* B or C, *special inspections* are not required for structural steel *seismic force-resisting systems* where the response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, has been used for design and detailing.
2. In structures assigned to *Seismic Design Category* D, E, or F, *special inspections* are not required for structural steel *seismic force-resisting systems* where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

1705.13.1.2 Structural steel elements. *Special inspections* of *structural steel elements* in the *seismic force-resisting systems* of buildings and structures assigned to *Seismic Design Category* B, C, D, E or F other than those covered in Section 1705.13.1.1, including struts, *collectors*, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

Exceptions:

1. In buildings and structures assigned to *Seismic Design Category* B or C, *special inspections* of *structural steel elements* are not required for *seismic force-resisting systems* with a response modification coefficient, R, of 3 or less.
2. In structures assigned to *Seismic Design Category* D, E, or F, *special inspections* of *structural steel elements* are not required for *seismic force-resisting systems* where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. *Special inspection* shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

[S] 1705.13.2 Structural wood. For the *seismic force-resisting systems* of structures assigned to *Seismic Design Category* C, D, E or F:

1. *Continuous special inspection* shall be required during field gluing operations of elements of the *seismic force-resisting system*.
2. *Periodic special inspection* shall be required for nailing, bolting, anchoring and other fastening of elements of the *seismic force-resisting system*, including wood *shear walls*, wood *diaphragms*, *drag struts*, braces, shear panels and *hold-downs*.

Exceptions:

1. *Special inspections* are not required for wood *shear walls*, shear panels and *diaphragms*, including nailing, bolting, anchoring and other fastening to other elements of the *seismic force-resisting system* other than adhesive-grouted anchor bolts, where the lateral resistance is provided by structural sheathing, and the specified fastener spacing at the panel edges is more than 4 inches (102 mm) on center.
2. *Special inspection* is not required for Group R-3 structures for other than structural insulated panels used as shear walls.
3. *Special inspection* is not required in Group R-1 and R-2 structures three *stories* and less in height for other than structural insulated panels used as shear walls.

4. *Special inspection* is not required for adhesive-grouted anchor bolts in Group R-1 and R-2 buildings if wood shear-wall fastener spacing is 4 inches (102 mm) or more on center (o.c.) and hold down capacities are less than 5,000 pounds (22.2 kN).

1705.13.3 Cold-formed steel light-frame construction. For the *seismic force-resisting systems* of structures assigned to *Seismic Design Category* C, D, E or F, *periodic special inspection* shall be required for both:

1. Welding operations of elements of the *seismic force-resisting system*.
2. Screw attachment, bolting, anchoring and other fastening of elements of the *seismic force-resisting system*, including shear walls, braces, *diaphragms*, *collectors* (*drag struts*) and *hold-downs*.

Exception: *Special inspections* are not required for cold-formed steel light-frame shear walls and *diaphragms*, including screw installation, bolting, anchoring and other fastening to components of the *seismic force-resisting system*, where either of the following applies:

1. The sheathing is gypsum board or *fiberboard*.
2. The sheathing is *wood structural panel* or steel sheets on only one side of the *shear wall*, shear panel or *diaphragm* assembly and the specified fastener spacing at the panel or sheet edge is more than 4 inches (102 mm) on center.

1705.13.4 Designated seismic systems. For structures assigned to *Seismic Design Category* C, D, E or F, the *special inspector* shall examine *designated seismic systems* requiring seismic qualification in accordance with Section 13.2.2 of ASCE 7 and verify that the label, anchorage and mounting conform to the *certificate of compliance*.

1705.13.5 Architectural components. *Periodic special inspection* is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior *veneer* in structures assigned to *Seismic Design Category* D, E or F.

Exception: *Periodic special inspection* is not required for the following:

1. Exterior cladding, interior and exterior nonbearing walls and interior and exterior *veneer* 30 feet (9144 mm) or less in height above grade or walking surface.
2. Exterior cladding and interior and exterior *veneer* weighing 5 psf (0.24 kN/m^2) or less.
3. Interior nonbearing walls weighing 15 psf (0.72 kN/m^2) or less.

1705.13.5.1 Access floors. Periodic *special inspection* is required for the anchorage of access floors in structures assigned to *Seismic Design Category* D, E or F.

[W] 1705.13.6 Plumbing, mechanical and electrical components. *Periodic special inspection* of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to *Seismic Design Category* C, D, E or F.
2. Anchorage of other electrical equipment in structures assigned to *Seismic Design Category* E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to *Seismic Design Category* C, D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to *Seismic Design Category* C, D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to *Seismic Design Category* C, D, E or F where the *approved construction documents* require a nominal clearance of 1/4 inch (6.4 mm) or less between the equipment support frame and restraint.
6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic sprinkler systems are installed in *Risk Category IV* structures assigned to *Seismic Design Category* C, D, E or F to verify one of the following:
   6.1. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7.
   6.2. A nominal clearance of not less than 3 inches (76 mm) has been be provided between automatic sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, *special inspection* of minimum clearances is not required.

1705.13.7 Storage racks. Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to *Seismic Design Category* D, E or F shall be provided with periodic special inspection as required by Table 1705.13.7.

1705.14.4 Seismic isolation systems. Seismic isolation systems in seismically isolated structures assigned to *Seismic Design Category* B, C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.

[BF] 1705.15 Sprayed fire-resistant materials. *Special inspections* and tests of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705.15.1 through 1705.15.6. *Special inspections* shall be based on the fire-resistance design as designated in the *approved construction documents*. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. *Special inspections* and tests shall be performed during construction with an additional visual inspection after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705.15.4.1 through 1705.15.4.9.

[BF] 1705.15.1 Physical and visual tests. The *special inspections* and tests shall include the following to demonstrate compliance with the listing and the *fire-resistance rating*:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot (kg/m^3).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705.15.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the *approved* fire-resistance design and the written instructions of *approved* manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the *special inspector* before the application of the sprayed fire-resistant material.

[S][BF] 1705.15.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of *approved* manufacturers. ((~~The area for application shall be ventilated during and after application as required by the written instructions of *approved* manufacturers.~~))

[BF] 1705.15.4 Thickness. Not more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the *approved* fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705.15.4.1.

[BF] 1705.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus 1/4 inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705.15.4.2 and 1705.15.4.3.

[BF] 1705.15.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705.15.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

[BF] 1705.15.4.5 Structural members. The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

[BF] 1705.15.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.8 Wide-flanged columns. At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.5 Density. The density of the sprayed fire-resistant material shall be not less than the density specified in the *approved* fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each *story*.

[BF] 1705.15.6 Bond strength. The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m^2). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705.15.6.1 through 1705.15.6.3.

[BF] 1705.15.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) of the sprayed area, or portion thereof, in each *story*.

[BF] 1705.15.6.2 Structural members. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each *story*.

[BF] 1705.15.6.3 Primer, paint and encapsulant bond tests. Bond tests to qualify a primer, paint or encapsulant shall be conducted where the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent *approved* by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

[BF] 1705.16 Mastic and intumescent fire-resistant coatings. *Special inspections* and tests for mastic and *intumescent fire-resistant coatings* applied to structural elements and decks shall be performed in accordance with AWCI 12-B. *Special inspections* and tests shall be based on the fire-resistance design as designated in the *approved construction documents*. *Special inspections* and tests shall be performed during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

[S] ((~~1705.17 Exterior insulation and finish systems (EIFS).~~ ~~*Special inspections* shall be required for all EIFS applications.~~

~~**Exceptions:**~~

1. ~~*Special inspections* shall not be required for EIFS applications installed over a *water-resistive barrier* with a means of draining moisture to the exterior.~~
2. ~~*Special inspections* shall not be required for EIFS applications installed over masonry or concrete walls.~~

~~**1705.17.1 Water-resistive barrier coating.** A *water-resistive barrier* coating complying with ASTM E2570 requires *special inspection* of the *water-resistive barrier* coating where installed over a sheathing substrate.~~))

[BF] ((~~1705.18~~)) 1705.17 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to *Risk Category* III or IV, or in *fire areas* containing Group R occupancies with an *occupant load* greater than 250, *special inspections* for *through-penetrations*, *membrane penetration* firestops, *fire-resistant joint systems* and perimeter fire containment systems that are tested and *listed* in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.

[BF] ((~~1705.18.1~~)) 1705.17.1 Penetration firestops. Inspections of *penetration firestop* systems that are tested and *listed* in accordance with Sections 714.4.1.2 and 714.5.1.2 shall be conducted by an *approved agency* in accordance with ASTM E2174.

[BF] ((~~1705.18.2~~)) 1705.17.2 Fire-resistant joint systems. Inspection of *fire-resistant joint systems* that are tested and *listed* in accordance with Sections 715.3.1 and 715.4 shall be conducted by an *approved agency* in accordance with ASTM E2393.

[S][F] ((~~1705.19~~)) 1705.18 Testing for smoke control. Smoke control systems shall be inspected and tested ((~~by a *special inspector*~~)) according to standards specified by the *building official*.

((~~**[F] 1705.19.1 Testing scope.** The test scope shall be as follows:~~

1. ~~During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.~~
2. ~~Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.~~

~~**[F] 1705.19.2 Qualifications.** *Approved* agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.~~))

((~~1705.20~~)) 1705.19 Sealing of mass timber. Periodic *special inspections* of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to *mass timber building elements* as designated in the *approved* construction documents.

SECTION 1706
DESIGN STRENGTHS OF MATERIALS

1706.1 Conformance to standards. The *design strengths* and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the *building official*, shall conform to the specifications and methods of design of accepted engineering practice or the *approved* rules in the absence of applicable standards.

1706.2 New materials. For materials that are not specifically provided for in this code, the *design strengths* and permissible stresses shall be established by tests as provided for in Section 1707.

SECTION 1707
ALTERNATIVE TEST PROCEDURE

[S] 1707.1 General. In the absence of *approved* rules or other *approved* standards, the *building official* shall make, or cause to be made, the necessary tests and investigations; or the *building official* shall accept duly authenticated reports from *approved agencies* in respect to the quality and manner of use of new materials or assemblies as provided for in Section ((~~104.11~~)) 104.4 or 104.5. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

SECTION 1708
IN-SITU LOAD TESTS

1708.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected *loads*, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected *loads*, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1708.2 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1708.2.1 or 1708.2.2 and shall be supervised by a *registered design professional*. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1708.2.1 Load test procedure specified. Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific *load factors* or acceptance criteria, the *load factors* and acceptance criteria in Section 1708.2.2 shall apply.

1708.2.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such *existing structure* shall be subjected to an approved test procedure developed by a *registered design professional* that simulates applicable loading and deformation conditions. For components that are not a part of the *seismic force-resisting system*, at a minimum the test load shall be equal to the specified factored design *loads*. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design *loads* being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic *loads* (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design *load*, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1709
PRECONSTRUCTION LOAD TESTS

1709.1 General. Where proposed construction is not capable of being designed by *approved* engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709. The *building official* shall accept certified reports of such tests conducted by an *approved* testing agency, provided that such tests meet the requirements of this code and *approved* procedures.

1709.2 Load test procedures specified. Where specific load test procedures, *load factors* and acceptance criteria are included in the applicable referenced standards, such test procedures, *load factors* and acceptance criteria shall apply. In the absence of specific test procedures, *load factors* or acceptance criteria, the corresponding provisions in Section 1709.3 shall apply.

1709.3 Load test procedures not specified. Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a *registered design professional* that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the *seismic force-resisting system*, the test shall be as specified in Section 1709.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1709.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the least of:

1. The load at the deflection limitation given in Section 1709.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1709.3.2 Deflection. The deflection of structural members under the design *load* shall not exceed the limitations in Section 1604.3.

1709.4 Wall and partition assemblies. *Load-bearing wall* and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

[W] 1709.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Section 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exceptions:

1. Structural wind load design pressures for window or door assemblies other than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be different than the design value of the tested assembly, provided that such pressures are determined by accepted engineering analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709.5.2. Components of the alternate size assembly shall be the same as the tested or labeled assembly. Where engineering analysis is used, it shall be performed in accordance with the analysis procedures of AAMA 2502.
2. Custom exterior windows and doors manufactured by *small business* are exempt from all testing requirements in Section 1709 if they meet the applicable provisions of Chapter 24.

1709.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and *labeled* as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The *label* shall state the name of the manufacturer, the *approved* labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and

labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

1709.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

((~~**1709.5.3 Windborne debris protection.** Protection of exterior glazed openings in buildings located in *windborne debris regions* shall be in accordance with Section 1609.2.~~))

1709.5.3.1 Impact protective systems testing and labeling. *Impact protective systems* shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996 and for design wind pressure for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with ASCE 7, and for the purposes of this section, multiplied by 0.6 to convert to *allowable stress design*.

Impact protective systems shall have a permanent label applied in accordance with Section 1703.5.4, identifying the manufacturer, product designation, performance characteristics, and approved inspection agency.

1709.6 Skylights and sloped glazing. *Skylights and sloped glazing* shall comply with the requirements of Chapter 24.

1709.7 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an *approved agency*.

CHAPTER 18

SOILS AND FOUNDATIONS

User notes:

About this chapter: *Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads imposed by the structure above. This chapter includes requirements for soils investigation and site preparation for receiving a foundation, including the load-bearing values for soils and protection for the foundation from frost and water intrusion. Section 1808 addresses the basic requirements for all foundation types while subsequent sections address foundation requirements that are specific to shallow foundations and deep foundations.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC–Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 1801
GENERAL

1801.1 Scope. The provisions of this chapter shall apply to building and foundation systems.

SECTION 1802
DESIGN BASIS

[S] 1802.1 General. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the *allowable stress design* load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23. Excavations, ((~~and~~)) fills and *land-disturbing activity* shall comply with Chapter 33, the Seattle Stormwater Code (*Seattle Municipal Code* Chapter 22.800), the Seattle Grading Code (*Seattle Municipal Code* Chapter 22.170), and the Regulations for Environmentally Critical Areas (*Seattle Municipal Code* Chapter 25.09) and any rules adopted and conditions imposed under any of them.

SECTION 1803
GEOTECHNICAL INVESTIGATIONS

[S] 1803.1 General. Geotechnical investigations shall be conducted in accordance with Section 1803.2 and reported in accordance with Section 1803.6. Where ((~~required by the *building official* or where~~)) geotechnical investigations involve in-situ testing, laboratory testing or engineering calculations, such investigations shall be conducted by a *registered design professional*.

1803.2 Investigations required. Geotechnical investigations shall be conducted in accordance with Sections 1803.3 through 1803.5.

Exception: The *building official* shall be permitted to waive the requirement for a geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections 1803.5.1 through 1803.5.6 and Sections 1803.5.10 and 1803.5.11.

1803.3 Basis of investigation. Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803.3.1 Scope of investigation. The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a *registered design professional*.

1803.4 Qualified representative. The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The *registered design professional* shall have a fully qualified representative on site during all boring or sampling operations.

1803.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803.5.1 through 1803.5.12.

1803.5.1 Classification. Soil materials shall be classified in accordance with ASTM D2487.

1803.5.2 Questionable soil. Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the *building official* shall be permitted to require that a geotechnical investigation be conducted.

1803.5.3 Expansive soil. In areas likely to have expansive soil, the *building official* shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No.200 sieve (75 μm), determined in accordance with ASTM D422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

[S] 1803.5.4 Ground-water table. A subsurface soil investigation shall be performed to determine whether the existing static ground-water table is above or within 5 feet (1524 mm) below the elevation of the *lowest floor* level where such floor is located below the finished ground level adjacent to the foundation.

Exception: A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with Section 1805.

1803.5.5 Deep foundations. Where *deep foundations* will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended *deep foundation* types and installed capacities.
2. Recommended center-to-center spacing of *deep foundation* elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of *deep foundation* materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

[S] 1803.5.6 Rock strata. Where subsurface explorations at the project site indicate variations in the structure of rock on which foundations are to be constructed, the *building official* is permitted to require a sufficient number of borings ((~~shall~~)) to be drilled to sufficient depths to assess the competency of the rock and its load-bearing capacity.

1803.5.7 Excavation near foundations. Where excavation will reduce support from any foundation, a *registered design professional* shall prepare an assessment of the structure as determined from examination of the structure, available design documents, available subsurface data, and, if necessary, excavation of test pits. The *registered design professional* shall determine the requirements for support and protection of any existing foundation and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by underpinning, bracing, excavation retention systems, or by other means acceptable to the *building official*.

1803.5.8 Compacted fill material. Where *shallow foundations* will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803.5.9 Controlled low-strength material (CLSM). Where *shallow foundations* will bear on *controlled low-strength material* (*CLSM*), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the *CLSM*.
2. Specifications for the *CLSM*.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the *CLSM*.
4. Test methods for determining the acceptance of the *CLSM* in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

[S] ((~~1803.5.10 Alternate setback and clearance.~~ ~~Where setbacks or clearances other than those required in Section 1808.7 are desired, the *building official* shall be permitted to require a geotechnical investigation by a *registered design professional* to demonstrate that the intent of Section 1808.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, *load* intensity and erosion characteristics of slope material.~~))

[S] 1803.5.11 Seismic Design Categories C through F. For structures assigned to *Seismic Design Category* C, D, E or F, and where the structure is located in an area known to be a geologic hazard area as defined in the Regulations for Environmentally Critical Areas (*Seattle Municipal Code* Chapter 25.09), a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

Exception: The *building official* is permitted to waive this evaluation upon receipt of the written opinion of a geotechnical engineer that the building's foundation design adequately addresses liquefaction.

1803.5.11.1 Slope instability. The potential for slope instability shall be evaluated for the design earthquake ground motion specified in Chapter 16 and Section 11.4.5 of ASCE 7. Peak ground acceleration is also permitted to be determined based on a site-specific study taking into account soil amplification effects. If a pseudostatic stability analysis is performed, the seismic coefficient shall correspond to some fraction of the anticipated peak ground acceleration.

[S] 1803.5.12 Seismic Design Categories D through F. For structures assigned to *Seismic Design Category* D, E or F, and where the structure is located in an area known to be a geologic hazard area as defined in the Regulations for Environmentally Critical Areas (*Seattle Municipal Code* Chapter 25.09), or where basement or retaining walls in geologic hazard areas exceed 12 feet (3658 mm) in height, the geotechnical investigation required by Section 1803.5.11 shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to *design earthquake ground motions*.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
    2.1. A site-specific study in accordance with Chapter 21 of ASCE 7.
    2.2. In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:
    3.1. Estimation of total and differential settlement.
    3.2. Lateral soil movement.
    3.3. Lateral soil *loads* on foundations.
    3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
    3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
    3.6. Increases in soil lateral pressures on retaining walls.
    3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to, the following:
    4.1. Selection of appropriate foundation type and depths.
    4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
    4.3. Ground stabilization.

4.4. Any combination of these measures and how they shall be considered in the design of the structure.

[S] 1803.6 Reporting. Where geotechnical investigations are required, a written report of the investigations shall be submitted to the *building official* by the permit applicant at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; mitigation of the effects of slope instability; and the effects of adjacent *loads*.
6. Expected total and differential settlement.
7. *Deep foundation* information in accordance with Section 1803.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803.5.8.
10. *Controlled low-strength material* properties and testing in accordance with Section 1803.5.9.

SECTION 1804
EXCAVATION, GRADING AND FILL

1804.1 Excavation near foundations. Excavation for any purpose shall not reduce vertical or lateral support for any foundation or adjacent foundation without first *underpinning* or protecting the foundation against detrimental lateral or vertical movement, or both, in accordance with Section 1803.5.7.

1804.2 Underpinning. Where *underpinning* is chosen to provide the protection or support of adjacent structures, the *underpinning* system shall be designed and installed in accordance with provisions of this chapter and Chapter 33.

1804.2.1 Underpinning sequencing. *Underpinning* shall be installed in a sequential manner that protects the neighboring structure and the working construction site. The sequence of installation shall be identified in the *approved construction documents*.

1804.3 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a *controlled low-strength material* (*CLSM*). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: *CLSM* need not be compacted.

1804.4 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an *approved* alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped not less than 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

Exceptions:

1. Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than 1 unit vertical in 48 units horizontal (2-percent slope).
2. Impervious surfaces shall be permitted to be sloped less than 2 percent where the surface is a door landing or *ramp* that is required to comply with Section 1010.1.4, 1012.3 or 1012.6.1.

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1804.5 Grading and fill in flood hazard areas. In *flood hazard areas* established in Section 1612.3, grading, fill, or both, shall not be *approved*:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of *flood* water and, as applicable, wave action.
2. In *floodways*, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a *registered design professional* in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in *flood* levels during the occurrence of the *design flood*.

Dampproofing shall consist of a bituminous material, 3 pounds per square *yard* (16 N/m^2) of acrylic modified cement, 1/8 inch (3.2 mm) coat of *surface-bonding mortar* complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805.3.2 or other *approved* methods or materials.

1805.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other *approved* methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than 3/8 inch (9.5 mm) of Portland cement *mortar*. The parging shall be coved at the footing.

Exception: Parging of unit masonry walls is not required where a material is *approved* for direct application to the masonry.

1805.3 Waterproofing. Where the ground-water investigation required by Section 1803.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805.1.3, walls and floors shall be waterproofed in accordance with this section.

1805.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other *approved* materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral *loads* to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other *approved* methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1.

1805.3.3 Joints and penetrations. *Joints* in walls and floors, *joints* between the wall and floor and penetrations of the wall and floor shall be made watertight utilizing *approved* methods and materials.

1805.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805.1.3 shall be deemed adequate for lowering the ground-water table.

1805.4.1 Floor base course. Floors of basements, except as provided for in Section 1805.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

1805.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend not less than 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an *approved* filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an *approved* filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

[S] 1805.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an *approved* drainage system that complies with the *International Plumbing Code*.

((~~Exception:~~ ~~Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.~~))**

TABLE 1807.1.6.3(4)—continued
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 8.75 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[e]	45[e]	60
9-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-4[e]	#6 at 72	#7 at 72	#8 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-0[e]	#6 at 72	#7 at 72	#8 at 72
	10-0[e]	#7 at 72	#8 at 72	#9 at 72

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.
a. For design lateral soil loads, see Section 1610.
b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.
c. For alternative reinforcement, see Section 1807.1.6.3.1.
d. For height of unbalanced backfill, see Section 1807.1.2.
e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

1807.2 Retaining walls. Retaining walls shall be designed in accordance with Sections 1807.2.1 through 1807.2.4.

1807.2.1 General. Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

[W] 1807.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil *loads* set forth in Section 1610. For structures assigned to *Seismic Design Category* D, E, or F, the design of retaining walls supporting more than 6 feet (1829 mm) of backfill height measured to the bottom of the footing shall incorporate the additional seismic lateral earth pressure in accordance with the geotechnical investigation where required in Section 1803.2.

1807.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605 shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake *loads*, 1.0 times other *nominal loads*, and investigation with one or more of the variable *loads* set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

1807.2.4 Segmental retaining walls. Dry-cast concrete units used in the construction of segmental retaining walls shall comply with ASTM C1372.

1807.3 Embedded posts and poles. Designs to resist both axial and lateral *loads* employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807.3.1 through 1807.3.3.

1807.3.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

1807.3.2 Design criteria. The depth to resist lateral *loads* shall be determined using the design criteria established in Sections 1807.3.2.1 through 1807.3.2.3, or by other methods *approved* by the *building official*.

1807.3.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral *loads* where lateral constraint is not provided at the ground surface, such as by a rigid floor or rigid ground

1808.3.2 Surcharge. Fill or other surcharge *loads* shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional *loads* caused by the fill or the surcharge. Existing footings or foundations that will be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against detrimental lateral or vertical movement or both.

Exception: Minor grading for landscaping purposes shall be permitted where done with walk-behind equipment, where the grade is not increased more than 1 foot (305 mm) from original design grade or where *approved* by the *building official*.

1808.4 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

1808.5 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

1808.6 Design for expansive soils. Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808.6.1 or 1808.6.2.

Exceptions: Foundation design need not comply with Section 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808.6.3.
2. The *building official* approves stabilization of the soil in accordance with Section 1808.6.4.

1808.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1808.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with WRI/CRSI *Design of Slab-on-Ground Foundations* or PTI DC 10.5. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI *Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

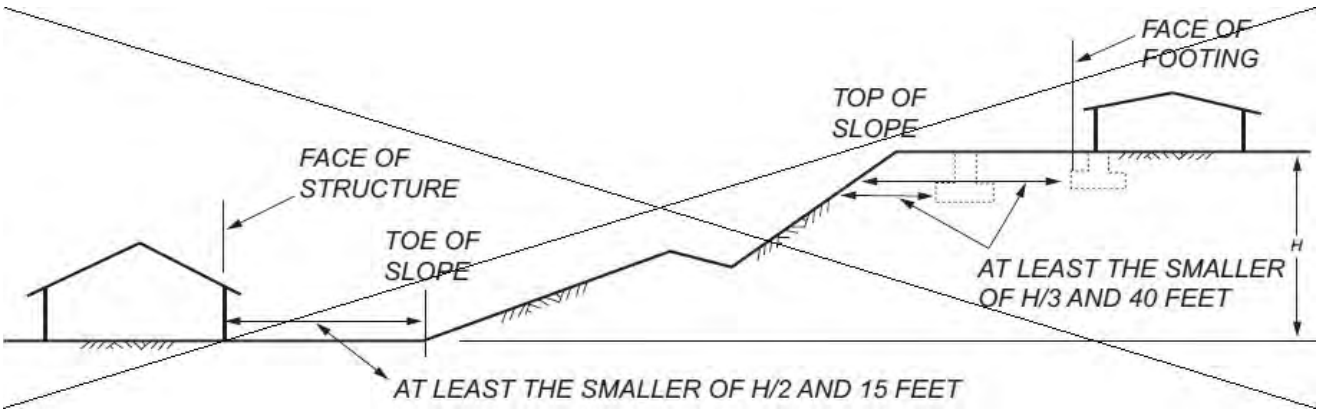
1808.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804.5 or 1804.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided that the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

1808.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

[S] 1808.7 ((~~Foundations on or adjacent to slopes~~)) Reserved. ((~~The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808.7.1 through 1808.7.5.~~

~~1808.7.1 Building clearance from ascending slopes.~~ ~~In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808.7.5 and Figure 1808.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100 percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.~~



~~For SI: 1 foot = 304.8 mm.~~

~~**FIGURE 1808.7.1**~~
~~**FOUNDATION CLEARANCES FROM SLOPES**~~

~~**1808.7.2 Foundation setback from descending slope surface.** Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808.7.5 and Figure 1808.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100 percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.~~

~~**1808.7.3 Pools.** The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.~~

~~**1808.7.4 Foundation elevation.** On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an *approved* drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the *building official*, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.~~

~~**1808.7.5 Alternate setback and clearance.** Alternate setbacks and clearances are permitted, subject to the approval of the *building official*. The *building official* shall be permitted to require a geotechnical investigation as set forth in Section 1803.5.10.~~))

1808.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.

Exception: Where concrete footings supporting walls of *light-frame construction* are designed in accordance with Table 1809.7, a specific design in accordance with Chapter 19 is not required.

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category A, B or C	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F	2,500 psi
2b. Foundations for other structures assigned to Seismic Design Category D, E or F	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

to change the elevation of the top surface of the footing or where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10-percent slope).

1809.4 Depth and width of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

1809.5 Frost protection. Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.
2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to *Risk Category* I.
2. Area of 600 square feet (56 m^2) or less for *light-frame construction* or 400 square feet (37 m^2) or less for other than *light-frame construction*.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

[S] ((~~1809.5.1 Frost protection at required exits.~~ ~~Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required *exit* doors.~~))

1809.6 Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an *approved* manner or a greater slope has been properly established by engineering analysis.

1809.7 Prescriptive footings for light-frame construction. Where a specific design is not provided, concrete or masonry-unit footings supporting walls of *light-frame construction* shall be permitted to be designed in accordance with Table 1809.7.

TABLE 1809.7
PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION[a, b, c, d, e]

NUMBER OF FLOORS SUPPORTED BY THE FOOTING[f]	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8[g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section 1809.4.
b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.
c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.
d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.
e. For thickness of foundation walls, see Section 1807.1.6.
f. Footings shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
g. Plain concrete footings for Group R-3 occupancies shall be permitted to be 6 inches thick.

1809.8 Plain concrete footings. The edge thickness of plain concrete footings supporting walls of other than *light-frame construction* shall be not less than 8 inches (203 mm) where placed on soil or rock.

Exception: For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

1809.9 Masonry-unit footings. The design, materials and construction of masonry-unit footings shall comply with Sections 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings supporting walls of *light-frame construction* shall be permitted to be designed in accordance with Table 1809.7.

3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For *Site Class* A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(g) of ACI 318 shall be permitted.

1810.3.9.4.2.2 Site Classes E and F. For *Site Class* E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810.3.9.5 Belled drilled shafts. Where *drilled shafts* are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810.3.9.6 Socketed drilled shafts. Socketed *drilled shafts* shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed *drilled shafts* shall have reinforcement or a structural steel core for the length as indicated by an *approved* method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the *drilled shaft*.

1810.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810.3.10.1 through 1810.3.10.4.

1810.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of 3/16 inch (4.8 mm). Splices shall comply with Section 1810.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression *load* in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

[S] 1810.3.10.4 Seismic reinforcement. For structures assigned to *Seismic Design Category* C, a permanent steel casing shall be provided from the top of the *micropile* down to the point of zero curvature. For structures assigned to *Seismic Design Category* D, E or F, the *micropile* shall be considered as an alternative system in accordance with Section ((~~104.11~~)) 104.5. The alternative system design, supporting documentation and test data shall be submitted to the *building official* for review and approval.

1810.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical *deep foundation* elements are connected, including grade beams and mats. The

when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless *approved* by the *building official*. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed *drilled shafts* shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810.4.10 Micropiles. *Micropile deep foundation* elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a *micropile* or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to ensure grout coverage outside the casing.

1810.4.11 Helical piles. *Helical piles* shall be installed to specified embedment depth and torsional resistance criteria as determined by a *registered design professional*. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the *helical pile*.

1810.4.12 Special inspection. *Special inspections* in accordance with Sections 1705.7 and 1705.8 shall be provided for driven and cast-in-place *deep foundation* elements, respectively. *Special inspections* in accordance with Section 1705.9 shall be provided for *helical piles*.

[S] SECTION 1811
METHANE REDUCTION MEASURES

1811.1 Applicability. This section applies to all construction activities on or within 1,000 feet (305 m) of an active, closed or abandoned landfill (landfill zone) that has been identified by the *building official* to be generating levels of methane gas on-site at the lower explosive limits or greater levels. The distance shall be calculated from the location of the proposed structure to the nearest property line of the active or former landfill site. The *building official* is permitted to waive these requirements if technical studies demonstrate that dangerous amounts of methane are not present on the location of the proposed structure.

1811.2 Protection of structures. All enclosed structures to be built within the 1,000 foot (305 m) landfill zone shall be protected from potential methane migration. The method for protecting a structure from methane shall be identified in a report prepared by a licensed civil engineer and submitted by the applicant to the *building official* for approval. The report shall contain a description of the investigation and recommendations for preventing the accumulation of explosive concentrations of methane gas within or under enclosed portions of the building or structure. At the time of final inspection, the civil engineer shall furnish a signed statement attesting that, to the best of the engineer's knowledge, the building or structure has been constructed in accordance with the recommendations for addressing methane gas migration.

1901.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

SECTION 1902
COORDINATION OF TERMINOLOGY

1902.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Sections 1902.1.1 and 1902.1.2.

1902.1.1 Design displacement. Design displacement at each level shall be the total lateral deflection at the level calculated for the design earthquake using the procedures defined in Section 12.8.6 of ASCE 7.

1902.1.2 Special structural wall. Special structural walls made of cast-in-place or precast concrete shall comply with the requirements of Sections 18.2.4 through 18.2.8, 18.10 and 18.11 of ACI 318, as applicable, in addition to the requirements for *ordinary reinforced concrete structural walls* or *ordinary precast structural walls*, as applicable. Where ASCE 7 refers to a "special reinforced concrete shear wall," it shall be deemed to mean a "special structural wall."

SECTION 1903
SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

1903.2 Special inspections. *Where required, special inspections and tests shall be in accordance with Chapter 17.*

1903.3 Glass fiber-reinforced concrete. *Glass fiber-reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

1903.4 Flat wall insulating concrete form (ICF) systems. *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634.*

SECTION 1904
DURABILITY REQUIREMENTS

1904.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

Exception: *For Group R-2 and R-3 occupancies not more than three stories above grade plane, the specified compressive strength, f´c, for concrete in basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather shall be not less than 3,000 psi (20.7 MPa).*

[S] 1904.2 Nonstructural concrete. *The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f´c, of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.*

Code Alternate CA1904.2: Five-sack 2000 psi (13.8 MPa) and five 1/2-sack 2500 psi (17.2 MPa) concrete mixes shall be deemed to comply with the requirements for 3000 psi (20.7 MPa) concrete in Sections 1904.1 and 1904.2. Air-entrainment is not required for durability purposes. Mixes shall be proportioned to produce a 5-inch or less slump, with a maximum allowable tolerance of 1-inch plus.

SECTION 1905
MODIFICATIONS TO ACI 318

[S] 1905.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through ((~~1905.1.8~~)) 1905.1.10.

1905.1.1 ACI 318, Section 2.3. Modify existing definitions and add the following definitions to ACI 318, Section 2.3.

DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, including 14.6.2.

ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

1.4. Anchor bolts are located a minimum of 1-3/4 inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:

2.1. The maximum anchor nominal diameter is 5/8 inch (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

2.3. Anchors are located a minimum of 1-3/4 inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.

3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

[S] 1905.1.9 ACI 318, Section 19.2.1.2. Modify ACI 318, Section 19.2.1.2, to read as follows:

19.2.1.2 The specified compressive strength shall be used for proportioning of concrete mixtures in Section 26.4.3 and for testing and acceptance of concrete in Section 26.12.3.

Exception: Concrete is permitted to be designed and constructed in accordance with Section 1905.1.10.

[S] 1905.1.10 ACI 318, Section 26.4.3. Modify ACI 318, Section 26.4.3 by adding new Section 26.4.3.2 as follows:

Concrete proportioning in accordance with Table 1905.1.10 is permitted to be used for concrete to be made with cements meeting strength requirements for Type I, II, or III of ASTM C 150. Table 1905.1.10 shall not be used to proportion concrete containing lightweight aggregates. If approved by the building official, Table 1905.1.10 is permitted to be used with air-entraining admixtures (conforming to ASTM C260) and/or normal-range water-reducing admixtures (conforming to ASTM C494-11 Standard Specification for Chemical Admixtures for Concrete, Types A, D or E; or C618-12 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete). For strengths greater than 4000 psi (27.7 MPa), proportions shall be established on the basis of field experience and trial mixtures according to ACI Section 26.4.3.1(b) or by proportioning without field mixtures or trial mixtures according to ACI Section 26.4.4.1(b). When approved by the building official, concrete proportions shall be determined in accordance with the provisions of ACI 318, Section 26.4.3.1(b) or 26.4.4.1(b).

[S] TABLE 1905.1.10
MINIMUM PERMISSIBLE CEMENT CONTENT FOR CONCRETE
(Strength Data from Trial Batches or Field Experience Are Not Available)

SPECIFIED 28-DAY COMPRESSIVE STRENGTH IN psi ($f'_{c,c}$)	MINIMUM PERMISSIBLE CEMENT CONTENT IN lb/cu yd	MINIMUM PERMISSIBLE CEMENT CONTENT IN STD. 94-lb SACKS/cu yd
2000	423	4-1/2[1]
2500	470	5[1]
3000	517	5-1/2
4000[2]	611	6-1/2

1. Where special inspection is not required under Section 1705, the minimum permissible cement content shall be increased by 1/2 sack per cubic yard of concrete.
2. For strengths above 4000 psi, see Section 1905.1.10.

2103.1.1 Second-hand units. Second-hand *masonry units* shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old *mortar* shall be cleaned from the unit before reuse.

2103.2 Mortar. *Mortar* for masonry construction shall comply with Section 2103.2.1, 2103.2.2, 2103.2.3 or 2103.2.4.

2103.2.1 Masonry mortar. *Mortar* for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103.2.2 Surface-bonding mortar. *Surface-bonding mortar* shall comply with ASTM C887. Surface bonding of concrete *masonry units* shall comply with ASTM C946.

2103.2.3 Mortars for ceramic wall and floor tile. Portland cement *mortars* for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.2.3.

TABLE 2103.2.3
CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; 1/5 hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; 1/2 hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; 1/10 hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; 1/2 hydrated lime; 2-1/2 dry sand or 3 damp sand

2103.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement *mortars*, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such *mortar* shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement *mortar* shall be installed in accordance with ANSI A108.5.

2103.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set *mortars* in which latex is added to dry-set *mortar* as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103.2.3.4 Furan mortar and grout. Chemical-resistant furan *mortar* and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion *mortar* and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion *mortar* and grout shall be installed in accordance with ANSI A108.9.

2103.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

[W] 2103.2.4 Mortar for adhered masonry veneer. *Mortar* for use with *adhered masonry veneer* shall conform to ASTM C270 for Type N or S, or shall comply with ANSI A118.4 or A118.15 for ((~~latex~~)) modified ((~~Portland~~)) dry set cement *mortar*. The cementitious bond coat shall comply with ANSI A118.4 or A118.15.

2103.3 Grout. Grout shall comply with Article 2.2 of TMS 602.

2103.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement is *approved* for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work.

mum thickness of back and sidewalls shall be 10 inches (254 mm) of *solid masonry*. Firebrick shall conform to ASTM C27 or ASTM C1261 and shall be laid with medium-duty refractory *mortar* conforming to ASTM C199.

2111.6.1 Steel fireplace units. Steel fireplace units are permitted to be installed with *solid masonry* to form a masonry fireplace provided that they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than 1/4 inch (6.4 mm) in thickness, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with *solid masonry* to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of *solid masonry* or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111.7 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, and the throat is not less than 12 inches (305 mm) above the lintel, and not less than 1/20 the cross-sectional area of the fireplace opening.

[W] 2111.8 Fireplaces. Fireplaces shall be provided with each of the following:

1. Tightly fitting flue dampers, operated by a readily accessible manual or *approved* automatic control.

   Exception: Fireplaces with gas logs shall be installed in accordance with *International Mechanical Code* Section 901, except that the standards for liquefied petroleum gas installations shall be NFPA 58 (*Liquefied Petroleum Gas Code*) and NFPA 54 (*National Fuel Gas Code*).

2. An outside source for combustion air ducted into the firebox. The duct shall be at least 6 square inches and shall be provided with an operable outside air duct damper.

   Exception: Washington certified fireplaces shall be installed with the combustion air systems necessary for their safe and efficient combustion and specified by the manufacturer in accordance with Section 2115.

3. Site built fireplaces shall have tight fitting glass or metal doors, or a flue draft induction fan or as *approved* for minimizing back-drafting. Factory built fireplaces shall use doors listed for the installed appliance.

2111.8.1 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The *fireplace throat* or damper shall be located not less than 8 inches (203 mm) above the top of the fireplace opening.

((~~2111.8.1~~)) 2111.8.1.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111.9 Smoke chamber walls. Smoke chamber walls shall be constructed of solid *masonry units*, hollow *masonry units* grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of *solid masonry*. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than 5/8 inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of *solid masonry*, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with refractory *mortar* conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

2111.9.1 Smoke chamber dimensions. The inside height of the smoke chamber from the *fireplace throat* to the beginning of the flue shall be not greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111.10 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed *loads*. Combustible material shall not remain against the underside of hearths or hearth extensions after construction.

2111.10.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

2111.10.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than 3/8-inch-thick (9.5 mm) brick, concrete, stone, tile or other *approved* noncombustible material is permitted.

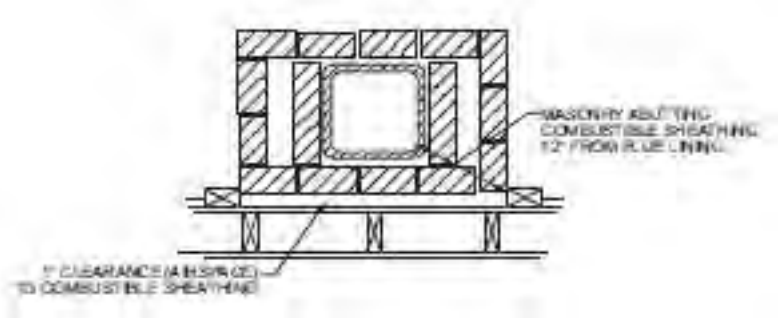


FIGURE 2113.19
ILLUSTRATION OF EXCEPTION THREE CHIMNEY CLEARANCE PROVISION

2113.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The *fireblocking* of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

SECTION 2114
DRY-STACK MASONRY

2114.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114.2 through 2114.5.

2114.2 Limitations. Dry-stack masonry shall be prohibited in *Risk Category* IV structures.

2114.3 Materials. Concrete *masonry units* complying with ASTM C90 shall be used.

2114.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed *loads* without exceeding the allowable stresses listed in Table 2114.4. Allowable stresses not specified in Table 2114.4 shall comply with the requirements of Chapter 8 of TMS 402.

TABLE 2114.4
GROSS CROSS-SECTIONAL AREA
ALLOWABLE STRESS FOR DRY-STACK MASONRY

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension	
Horizontal span	30
Vertical span	18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

[W] SECTION 2115
EMISSION STANDARDS

[W] 2115.1 Emission standards for factory-built fireplaces. New and used factory-built fireplaces shall be certified and labeled in accordance with procedures and criteria specified in ASTM E2558 Standard Test Method for Determining Particulate Matter Emission from Fires in Low Mass Wood-burning Fireplaces.

To certify an entire fireplace model line, the internal assembly shall be tested to determine its particulate matter emission performance. Retesting and recertifying is required if the design and construction specifications of the fireplace model line internal assembly change. Testing for certification shall be performed by a Washington State Department of Ecology (DOE) approved and U.S. Environmental Protection Agency (EPA) accredited laboratory.

[W] 2115.2 Emission standards for certified masonry and concrete fireplaces. Masonry and concrete fireplace model lines certified to Washington State Building Code Standard 31-2 prior to July 1, 2013, may retain certification if the design and construction specifications of the fireplace model line internal assembly do not change.

[W] 2303.1.1.3 Used solid-sawn lumber. Used solid-sawn dimensional lumber in good condition and devoid of areas of decay, not meeting the requirements of Sections 2303.1.1, 2303.1.1.1 or 2303.1.1.2, that has a nominal thickness of 2 inches with a nominal width of 6 inches or less, shall be assumed to be spruce-pine-fir stud grade and shall have structural properties assigned in accordance with current adopted standards. All other dimensional lumber shall be assumed to be hem-fir No. 2 grade and shall have structural properties assigned in accordance with current adopted standards.

2303.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for *prefabricated wood I-joists* shall be established and monitored in accordance with ASTM D5055.

2303.1.3 Structural glued-laminated timber. Glued-laminated timbers shall be manufactured and identified as required in ANSI/APA 190.1 and ASTM D3737.

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.

2303.1.5 Wood structural panels. *Wood structural panels*, where used structurally (including those used for siding, roof and wall sheathing, subflooring, *diaphragms* and built-up members), shall conform to the requirements for their type in DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Each panel or member shall be identified for grade, bond classification, and *Performance Category* by the trademarks of an *approved* testing and grading agency. The *Performance Category* value shall be used as the "nominal panel thickness" or "panel thickness" whenever referenced in this code. *Wood structural panel* components shall be designed and fabricated in accordance with the applicable standards listed in Section 2306.1 and identified by the trademarks of an *approved* testing and inspection agency indicating conformance to the applicable standard. In addition, *wood structural panels* where permanently exposed in outdoor applications shall be of exterior type, except that *wood structural panel* roof sheathing exposed to the outdoors on the underside is permitted to be Exposure 1 type.

2303.1.6 Fiberboard. *Fiberboard* for its various uses shall conform to ASTM C208. *Fiberboard* sheathing, where used structurally, shall be identified by an *approved* agency as conforming to ASTM C208.

2303.1.6.1 Jointing. To ensure tight-fitting assemblies, edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

2303.1.6.2 Roof insulation. Where used as roof insulation in all types of construction, *fiberboard* shall be protected with an *approved roof covering*.

2303.1.6.3 Wall insulation. Where installed and fireblocked to comply with Chapter 7, *fiberboards* are permitted as wall insulation in all types of construction. In *fire walls* and *fire barriers*, unless treated to comply with Section 803.1 for Class A materials, the boards shall be cemented directly to the concrete, masonry or other noncombustible base and shall be protected with an *approved* noncombustible *veneer* anchored to the base without intervening airspaces.

2303.1.6.3.1 Protection. *Fiberboard* wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

2303.1.7 Hardboard. *Hardboard* siding shall conform to the requirements of ANSI A135.6 and, where used structurally, shall be identified by the *label* of an *approved agency*. *Hardboard* underlayment shall meet the strength requirements of 7/32-inch (5.6 mm) or 1/4-inch (6.4 mm) service class *hardboard* planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished *hardboard* paneling shall meet the requirements of ANSI A135.5. Other basic *hardboard* products shall meet the requirements of ANSI A135.4. *Hardboard* products shall be installed in accordance with manufacture's recommendations.

2303.1.8 Particleboard. *Particleboard* shall conform to ANSI A208.1. *Particleboard* shall be identified by the grade *mark* or certificate of inspection issued by an *approved agency*. *Particleboard* shall not be utilized for applications other than indicated in this section unless the *particleboard* complies with the provisions of Section 2306.3.

2303.1.8.1 Floor underlayment. *Particleboard* floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall be not less than 1/4-inch (6.4 mm) thick and shall be installed in accordance with the instructions of the Composite Panel Association.

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPA U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

2303.1.9.1 Identification. Wood required by Section 2304.12 to be preservative treated shall bear the quality *mark* of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the *preservative-treated wood*. Inspection agencies for *preservative-treated wood* shall be *listed* by an *accreditation body* that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality *mark* shall be on a stamp or *label* affixed to the *preservative-treated wood*, and shall include the following information:

1. Identification of treating manufacturer.

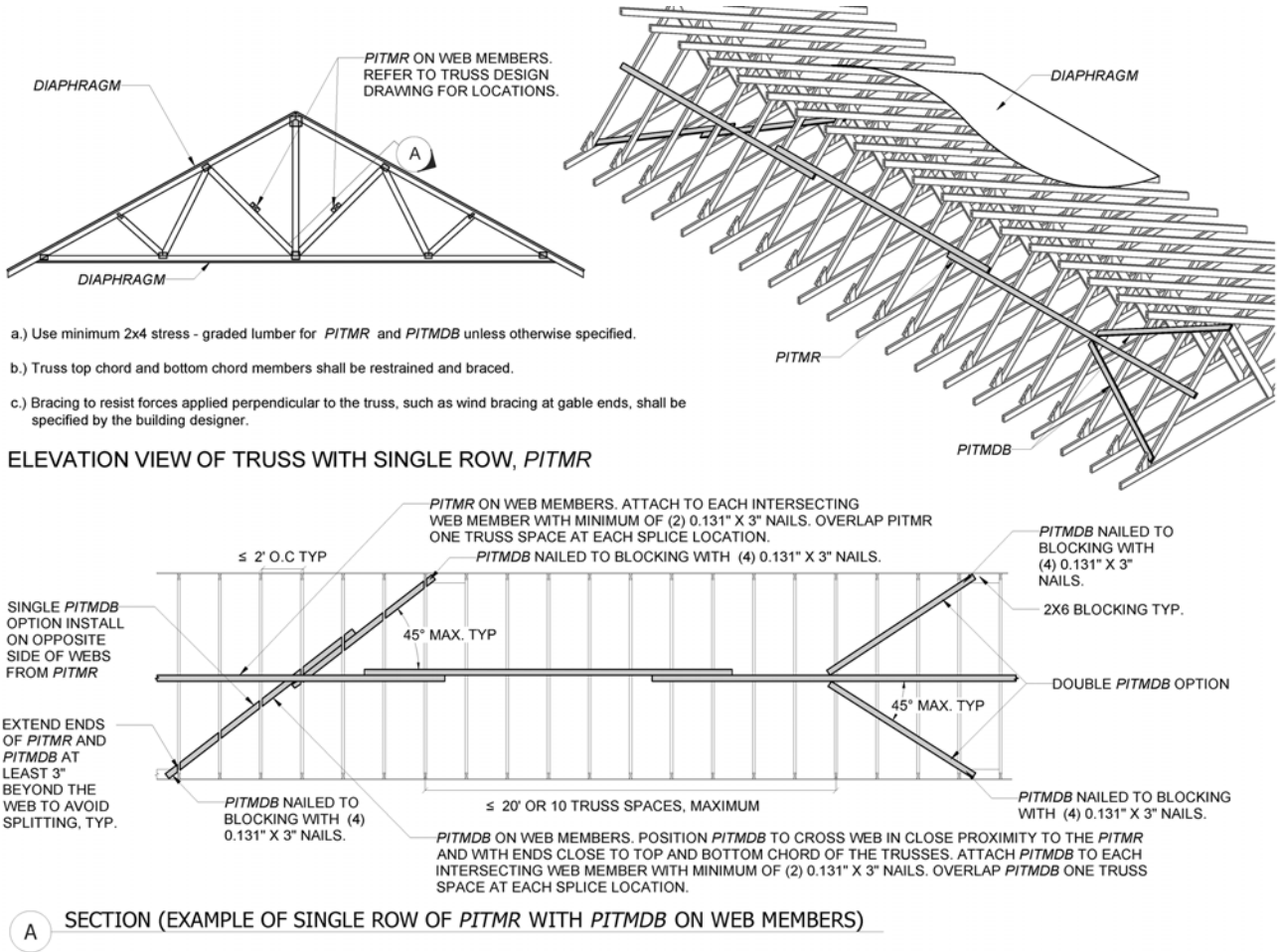
12. Calculated span-to-deflection ratio and maximum vertical and horizontal deflection for live and total *load* as applicable.
13. Maximum axial tension and compression forces in the truss members.
14. Required permanent *individual truss member* restraint location and the method and details of restraint and diagonal bracing to be used in accordance with Section 2303.4.1.2.

[S] 2303.4.1.2 Permanent individual truss member restraint (PITMR) and permanent individual truss member diagonal bracing (PITMDB). Where the truss design drawings designate the need for *permanent individual truss member restraint*, it shall be accomplished by one of the following methods:

1. *PITMR* and *PITMDB* installed using standard industry lateral restraint and diagonal bracing details in accordance with TPI 1, Section 2.3.3.1.1, accepted engineering practice, or Figures 2303.4.1.2(1), (3), and (5).
2. *Individual truss member* reinforcement in place of the specified lateral restraints (i.e., buckling reinforcement such as T-reinforcement, L-reinforcement, proprietary reinforcement, etc.) such that the buckling of any individual truss member is resisted internally by the individual truss. The buckling reinforcement of individual truss members shall be installed as shown on the truss design drawing, on supplemental truss member buckling reinforcement details provided by the truss designer or in accordance with Figures 2303.4.1.2 (2) and (4).
3. A project-specific *PITMR* and *PITMDB* design provided by any qualified *registered design professional*.

2303.4.1.2.1 Trusses installed without a diaphragm. Trusses installed without a *diaphragm* on the top or bottom chord shall require a project specific *PITMR* and *PITMDB* design prepared by a *registered design professional*.

Exception: Group U occupancies.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(1)
PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING ONE ROW OF PITMR

2303.4.1.3 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with any qualified *registered design professional* for the design of the temporary installation restraint and diagonal bracing and the *PITMR* and *PITMDB* for all trusses with clear spans 60 feet (18 288 mm) or greater.

2303.4.1.4 Truss designer. The individual or organization responsible for the design of trusses.

2303.4.1.4.1 Truss design drawings. Where required by the *registered design professional*, the *building official* or the statutes of the jurisdiction in which the project is to be constructed, each individual truss design drawing shall bear the seal and signature of the truss designer.

Exceptions:

1. Where a cover sheet and truss index sheet are combined into a single sheet and attached to the set of truss design drawings, the single cover/truss index sheet is the only document required to be signed and sealed by the truss designer.
2. Where a cover sheet and a truss index sheet are separately provided and attached to the set of truss design drawings, the cover sheet and the truss index sheet are the only documents required to be signed and sealed by the truss designer.

2303.4.2 Truss placement diagram. The truss manufacturer shall provide a truss placement diagram that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing. The truss placement diagram shall be provided as part of the truss submittal package, and with the shipment of trusses delivered to the job site. Truss placement diagrams that serve only as a guide for installation and do not deviate from the *permit* submittal drawings shall not be required to bear the seal or signature of the truss designer.

2303.4.3 Truss submittal package. The truss submittal package provided by the truss manufacturer shall consist of each individual truss design drawing, the truss placement diagram, the permanent *individual truss member* restraint/bracing method and details and any other structural details germane to the trusses; and, as applicable, the cover/truss index sheet.

2303.4.4 Anchorage. The design for the transfer of *loads* and anchorage of each truss to the supporting structure is the responsibility of the *registered design professional*.

2303.4.5 Alterations to trusses. Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of a *registered design professional*. Alterations resulting in the addition of *loads* to any member (for example, HVAC equipment, piping, additional roofing or insulation) shall not be permitted without verification that the truss is capable of supporting such additional loading.

[S] 2303.4.6 TPI 1 specifications. In addition to Sections 2303.4.1 through 2303.4.5, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1. Job-site inspections shall be in compliance with Section ((~~110.4~~)) 108, as applicable.

2303.4.7 Truss quality assurance. Trusses not part of a manufacturing process in accordance with either Section 2303.4.6 or a referenced standard, which provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704.2.5 and 1705.5, as applicable.

2303.5 Test standard for joist hangers. Joist hangers shall be in accordance with ASTM D7147.

[W] 2303.6 Nails and staples. Nails and staples shall conform to requirements of ASTM F1667, including Supplement 1. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 kips per square inch (ksi) (551 MPa) for shank diameters larger than 0.177 inch (4.50 mm) but not larger than 0.254 inch (6.45 mm), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm) but not larger than 0.177 inch (4.50 mm) and 100 ksi (689 MPa) for shank diameters of not less than 0.099 inch (2.51 mm) but not larger than 0.142 inch (3.61 mm). Staples used for framing and sheathing connections shall have minimum average bending moments as follows: 3.6 in.-lbs (0.41 N-m) for No. 16 gage staples, 4.0 in.-lbs (0.45 N-m) for No. 15 gage staples, and 4.3 in.-lbs (0.49 N-m) for No. 14 gage staples. Staples allowable bending moments shall be listed on the construction documents.

2303.7 Shrinkage. Consideration shall be given in design for the effects of wood cross-grain dimensional changes that occur as a result of changes in the wood moisture content after installation.

SECTION 2304
GENERAL CONSTRUCTION REQUIREMENTS

2304.1 General. The provisions of this section apply to design methods specified in Section 2302.1.

2304.2 Size of structural members. Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

2304.3 Wall framing. The framing of exterior and interior walls shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

a. Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
b. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
c. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
d. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.
e. Tabulated fastener requirements apply where the ultimate design wind speed is less than 140 mph. For wood structural panel roof sheathing attached to gable-end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C. Spacing exceeding 6 inches on center at intermediate supports shall be permitted where the fastening is designed per the AWC NDS.
f. Fastening is only permitted where the ultimate design wind speed is less than or equal to 110 mph.
g. Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section ((~~104.11~~)) 104.5.

2304.10.3 Sheathing fasteners. Sheathing nails or other *approved* sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

2304.10.4 Joist hangers and framing anchors. Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where *approved*. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D7147.

2304.10.5 Other fasteners. Clips, staples, glues and other *approved* methods of fastening are permitted where *approved*.

2304.10.6 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with *preservative-treated* and *fire-retardant-treated wood* shall be in accordance with Sections 2304.10.6.1 through 2304.10.6.4. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

2304.10.6.1 Fasteners and connectors for preservative-treated wood. Fasteners, including nuts and washers, in contact with *preservative-treated wood* shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Connectors that are used in exterior applications and in contact with *preservative-treated wood* shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653, Type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exception: Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate *preservative-treated wood* in an interior, dry environment shall be permitted.

2304.10.6.2 Fastenings for wood foundations. Fastenings, including nuts and washers, for wood foundations shall be as required in AWC PWF.

2304.10.6.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners, including nuts and washers, for *fire-retardant-treated wood* used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.

2304.10.6.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners, including nuts and washers, for *fire-retardant-treated wood* used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, Section 2304.10.6.3 shall apply.

2304.10.7 Load path. Where wall framing members are not continuous from the foundation sill to the roof, the members shall be secured to ensure a continuous *load* path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other *approved* corrosion-resistant material not less than 0.0329-inch (0.836 mm) base metal thickness.

2304.10.8 Framing requirements. Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive *loads*, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

2304.11 Heavy timber construction. Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the *building elements* therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4. Lumber decking shall be in accordance with Section 2304.9.

TABLE 2304.11
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	6-3/4	8-1/4	7	7-1/2
	Wood beams and girders	6	10	5	10-1/2	5-1/4	9-1/2
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	8-1/4	5-1/4	7-1/2
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	5-1/4	5-1/2
	Framed timber trusses and other roof framing;[a] Framed or glued-laminated arches that spring from the top of walls or wall abutments	4[b]	6	3[b]	6-7/8	3-1/2[b]	5-1/2

For SI: 1 inch = 25.4 mm.

a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.

b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

2304.11.1 Details of heavy timber structural members. Heavy timber structural members shall be detailed and constructed in accordance with Sections 2304.11.1 through 2304.11.1.3.

2304.11.1.1 Columns. Minimum dimensions of columns shall be in accordance with Table 2304.11. Columns shall be continuous or superimposed throughout all stories and connected in an *approved* manner. Girders and beams at column connections shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal *loads* across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof *loads* only. Where traditional heavy timber detailing is used, connections shall be by means of reinforced concrete or metal caps with brackets, by properly designed steel or iron caps, with pintles and base plates, by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other *approved* methods.

2304.11.1.2 Floor framing. Minimum dimensions of floor framing shall be in accordance with Table 2304.11. *Approved* wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by an *approved* metal hanger into which the ends of the beams shall be closely fitted. Where traditional heavy timber detailing is used, these connections shall be permitted to be supported by ledgers or blocks securely fastened to the sides of the girders.

2304.11.1.3 Roof framing. Minimum dimensions of roof framing shall be in accordance with Table 2304.11. Every roof girder and not less than every alternate roof beam shall be anchored to its supporting member to resist forces as required in Chapter 16.

[W] 2304.11.2 Partitions and walls. Partitions and walls shall comply with Section 2304.11.2.1 or 2304.11.2.2.

2304.11.2.1 Exterior walls. *Exterior walls* shall be permitted to be *cross-laminated timber* not less than ((~~4 inches (102 mm)~~)) 3.5 inches (88 mm) in actual thickness meeting the requirements of Section 2303.1.4.

2304.11.2.2 Interior walls and partitions. Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction ((~~4 inches (102 mm) thick~~)) 3.5 inches (88 mm) in actual thickness, or of 1-hour fire-resistance-rated construction.

2304.11.3 Floors. Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

2304.11.3.1 Cross-laminated timber floors. *Cross-laminated timber* shall be not less than ((~~4 inches (102 mm)~~)) 3.5 inches (88 mm) in actual thickness. *Cross-laminated timber* shall be continuous from support to support and mechanically fastened to one another. *Cross-laminated timber* shall be permitted to be connected to walls without a shrinkage

gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

2304.11.3.2 Sawn or glued-laminated plank floors. Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, 15/32-inch (12 mm) *wood structural panel* or 1/2-inch (12.7 mm) *particleboard*.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or 15/32-inch (12 mm) *wood structural panel* or 1/2-inch (12.7 mm) *particleboard*.

The lumber shall be laid so that continuous lines of joints will occur only at points of support. Floors shall not extend closer than 1/2 inch (12.7 mm) to walls. Such 1/2-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

2304.11.4 Roof decks. Roofs shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Roof decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be an alternative that provides equivalent *fire resistance* and structural properties. Where supported by a wall, *roof decks* shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or *approved* hardware of sufficient strength to resist prescribed forces.

2304.11.4.1 Cross-laminated timber roofs. *Cross-laminated timber* roofs shall be not less than ((~~3 inches (76 mm)~~)) 2.5 inches (63 mm) nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.

2304.11.4.2 Sawn, wood structural panel, or glued-laminated plank roofs. Sawn, *wood structural panel*, or glued-laminated plank roofs shall be one of the following:

1. Sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness.
2. 1-1/8-inch-thick (32 mm) *wood structural panel* (exterior glue).
3. Planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors.

2304.12 Protection against decay and termites. Wood shall be protected from decay and termites in accordance with the applicable provisions of Sections 2304.12.1 through 2304.12.4.

2304.12.1 Locations requiring waterborne preservatives or naturally durable wood. Wood used above ground in the locations specified in Sections 2304.12.1.1 through 2304.12.1.5 shall be *naturally durable wood* or *preservative-treated wood* using waterborne preservatives, in accordance with AWPA U1 for above-ground use.

2304.12.1.1 Joists, girders and subfloor. Wood joists or wood structural floors that are closer than 18 inches (457 mm) or wood girders that are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation shall be of naturally durable or *preservative-treated wood*.

2304.12.1.2 Wood supported by exterior foundation walls. Wood framing members, including wood sheathing, that are in contact with exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or *preservative-treated wood*.

2304.12.1.3 Exterior walls below grade. Wood framing members and furring strips in direct contact with the interior of exterior masonry or concrete walls below grade shall be of naturally durable or *preservative-treated wood*.

2304.12.1.4 Sleepers and sills. Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or *preservative-treated wood*.

2304.12.1.5 Wood siding. Clearance between wood siding and earth on the exterior of a building shall be not less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or *preservative-treated wood*.

2304.12.2 Other locations. Wood used in the locations specified in Sections 2304.12.2.1 through 2304.12.2.8 shall be *naturally durable wood* or *preservative-treated* wood in accordance with AWPA U1. *Preservative-treated* wood used in interior locations shall be protected with two coats of urethane, shellac, latex epoxy or varnish unless waterborne preservatives are used. Prior to application of the protective finish, the wood shall be dried in accordance with the manufacturer's recommendations.

2304.12.2.1 Girder ends. The ends of wood girders entering exterior masonry or concrete walls shall be provided with a 1/2-inch (12.7 mm) airspace on top, sides and end, unless naturally durable or *preservative-treated wood* is used.

SECTION 2405
SLOPED GLAZING AND SKYLIGHTS

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope of more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1.

Annealed glass is permitted to be used as specified in Exceptions 2 and 3 of Section 2405.3.

Laminated glass and plastic materials described in Items 1 and 2 shall not require the screening or height restrictions provided in Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2110.1.

[W] 2405.3 Screening. Where used in monolithic glazing systems, annealed, heat-strengthened, fully tempered and wired glass shall have broken glass retention screens installed below the glazing material. The screens and their fastenings shall be:

1. ((~~capable~~)) Capable of supporting twice the weight of the glazing;
2. ((~~firmly~~)) Firmly and substantially fastened to the framing members; and
3. ((~~installed~~)) Installed within 4 inches (102 mm) of the glass.

The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Annealed, heat-strengthened, fully tempered and wired glass, where used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

Exception: In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible *greenhouses* used exclusively for growing plants and not open to the public, provided that the height of the *greenhouse* at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Screens shall not be required in individual *dwelling units* in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:
   4.1. Each pane of the glass is 16 square feet (1.5 m^2) or less in area.
   4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
   4.3. The glass thickness is 3/16 inch (4.8 mm) or less.
5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used in individual *dwelling units* in Groups R-2, R-3 and R-4 within the following limits:
   5.1. Each pane of glass is 16 square feet (1.5 m^2) or less in area.
   5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

2405.4 Framing. In Types I and II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, *approved* pressure-treated wood or other *approved* noncorrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof *loads* in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted not less than 4 inches (102 mm) above the plane of the

SECTION 2407
GLASS IN HANDRAILS AND GUARDS

2407.1 Materials. Glass used in a *handrail* or a *guard* shall be laminated glass constructed of fully tempered or heat-strengthened glass and shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1. Glazing in a *handrail* or a *guard* shall be of an *approved* safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be 1/4 inch (6.4 mm).

Exception: Single fully tempered glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1 shall be permitted to be used in *handrails* and guards where there is no walking surface beneath them or the walking surface is permanently protected from the risk of falling glass.

2407.1.1 Loads. Glass *handrails* and guards and their support systems shall be designed to withstand the *loads* specified in Section 1607.9. Glass *handrails* and *guards* shall be designed using a factor of safety of four.

2407.1.2 Guards with structural glass balusters. *Guards* with structural glass balusters, whether vertical posts, columns or panels, shall be installed with an attached top rail or *handrail*. The top rail or *handrail* shall be supported by not fewer than three glass balusters, or shall be otherwise supported to remain in place should one glass baluster fail.

Exception: An attached top rail or *handrail* is not required where the glass baluster panels are laminated glass with two or more glass plies of equal thickness and of the same glass type. The balusters shall be tested to remain in place as a barrier following impact or glass breakage in accordance with ASTM E2353.

2407.1.3 Parking garages. Glazing materials shall not be installed in *handrails* or *guards* in parking garages except for pedestrian areas not exposed to impact from vehicles.

2407.1.4 Glazing in windborne debris regions. Glazing installed in exterior *handrails* or *guards* in *windborne debris regions* shall be laminated glass complying with Category II of CPSC 16 CFR 1201 or Class A of ANSI Z97.1. Where the top rail is supported by glass, the assembly shall be tested according to the impact requirements of Section 1609.2 and the top rail shall remain in place after impact.

SECTION 2408
GLAZING IN ATHLETIC FACILITIES

2408.1 General. Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with this section.

2408.2 Racquetball and squash courts.

2408.2.1 Testing. Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact *loads* shall conform to those of CPSC 16 CFR Part 1201 or ANSI Z97.1 with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall be not greater than 1-1/2 inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus 1/2 inch (12.7 mm) for a drop height of 48 inches (1219 mm).

2408.3 Gymnasiums and basketball courts. Glazing in multipurpose gymnasiums, basketball courts and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

SECTION 2409
GLASS IN WALKWAYS, ELEVATOR HOISTWAYS AND ELEVATOR CARS

[S] 2409.1 Glass walkways. Glass installed as ((~~a part of a floor/ceiling assembly as~~)) a walking surface ((~~and constructed with~~)) shall comply with Chapter 16.

Exception: ((~~laminated~~)) Laminated glass ((~~shall comply~~)) designed in accordance with ASTM E2751 ((~~or with the *load* requirements specified in~~)) is not required to comply with Chapter 16. Such assemblies shall comply with the *fire-resistance rating* and marking requirements of this code where applicable.

CHAPTER 25

GYPSUM BOARD, GYPSUM PANEL PRODUCTS AND PLASTER

User notes:

About this chapter: *Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum board, gypsum panel products and plaster and, in addition, addresses reinforced gypsum concrete. These materials are some of the most commonly used interior and exterior finish materials in the building industry. This chapter primarily addresses quality-control-related issues with regard to material specifications and installation requirements. Most products are manufactured in accordance with industry standards. The building official or inspector needs to verify that the appropriate product is used and properly installed for the intended use and location. Proper design and installation of these materials are necessary to provide weather resistance and required fire protection for both structural and nonstructural building components.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 2501
GENERAL

2501.1 Scope. Provisions of this chapter shall govern the materials, design, construction and quality of *gypsum board*, *gypsum panel products*, lath, *gypsum plaster*, *cement plaster* and reinforced gypsum concrete.

2501.2 Other materials. Other *approved* wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

SECTION 2502
PERFORMANCE

2502.1 General. Lathing, plastering and *gypsum board* and *gypsum panel product* construction shall be done in the manner and with the materials specified in this chapter and, where required for fire protection, shall comply with the provisions of Chapter 7.

SECTION 2503
INSPECTION

[S] 2503.1 Inspection. Lath, *gypsum board* and *gypsum panel products* shall be inspected in accordance with Section ((~~110.3.6~~)) 108.9.

SECTION 2504
VERTICAL AND HORIZONTAL ASSEMBLIES

2504.1 Scope. The following requirements shall be met where construction involves *gypsum board*, *gypsum panel products* or lath and plaster in vertical and *horizontal assemblies*.

2504.1.1 Wood framing. Wood supports for lath, *gypsum board* or *gypsum panel products*, as well as wood stripping or furring, shall be not less than 2 inches (51 mm) nominal thickness in the least dimension.

Exception: The minimum nominal dimension of wood furring strips installed over solid backing shall be not less than 1 inch by 2 inches (25 mm by 51 mm).

2504.1.2 Studless partitions. The minimum thickness of vertically erected studless solid plaster partitions of 3/8-inch (9.5 mm) and 3/4-inch (19.1 mm) rib metal lath, 1/2-inch-thick (12.7 mm) gypsum lath, *gypsum board* or *gypsum panel product* shall be 2 inches (51 mm).

SECTION 2505
SHEAR WALL CONSTRUCTION

2505.1 Resistance to shear (wood framing). Wood-frame *shear walls* sheathed with *gypsum board*, *gypsum panel products* or lath and plaster shall be designed and constructed in accordance with Section 2306.3 and are permitted to resist wind and seismic *loads*. Walls resisting seismic *loads* shall be subject to the limitations in Section 12.2.1 of ASCE 7.

CHAPTER 27
ELECTRICAL

User note:

About this chapter: *Electrical systems and components are integral to most structures; therefore, it is necessary for the code to address their installation and protection. Structures depend on electricity for the operation of many life safety systems including fire alarm, smoke control and exhaust, fire suppression, fire command and communication systems. Since power supply to these systems is essential, Chapter 27 addresses where standby and emergency power must be provided.*

SECTION 2701
GENERAL

[S] 2701.1 Scope. The provisions of this chapter and ((~~NFPA 70~~)) the *Seattle Electrical Code* shall govern the design, construction, erection and installation of the electrical components, appliances, equipment and systems used in buildings and structures covered by this code. The *International Fire Code*, the *International Property Maintenance Code* and ((~~NFPA 70~~)) the *Seattle Electrical Code* shall govern the use and maintenance of electrical components, appliances, equipment and systems. The *International Existing Building Code* and ((~~NFPA 70~~)) the *Seattle Electrical Code* shall govern the alteration, repair, relocation, replacement and addition of electrical components, appliances, or equipment and systems. Energy storage systems shall also comply with the *International Fire Code* and *Seattle Electrical Code*.

SECTION 2702
EMERGENCY AND LEGALLY REQUIRED STANDBY POWER SYSTEMS

[S][F] 2702.1 General. Emergency power systems and *legally required standby power systems* shall comply with Sections 2702.1.1 through 2702.1.8.

[S][F] 2702.1.1 Stationary generators. Stationary emergency and legally required standby power generators required by this code shall be listed in accordance with UL 2200.

[S][F] 2702.1.2 Fuel-line piping protection. Fuel lines supplying a generator set inside a *high-rise building* shall be separated from areas of the *building* other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than ((~~2 hours~~)) 1 hour. ((~~Where the *building* is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.~~))
2. An assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required fire-resistance rating shall be reduced to 1 hour.
3. Other approved methods.

[S][F] 2702.1.3 Installation. Emergency power systems and *legally required standby power systems* required by this code or the *International Fire Code* shall be installed in accordance with the *International Fire Code*, ((~~NFPA 70~~)) the *Seattle Electrical Code*, NFPA 110 and NFPA 111.

Exceptions:

1. Where located within a sprinklered parking garage of Type I or II construction, emergency power and *legally required standby power systems* with fixed fuel quantities meeting the limits of Section 605.4.2.2 of the *International Fire Code*, and their transfer switches, are not required to be in a separate room. Other occupancies located in the *story* where the system is located shall be separated from the system by fire barriers with a minimum 1-hour fire-resistance rating.
2. Combustion and radiator intake air are permitted to be transferred from the adjacent garage. Radiator discharge air is permitted to be transferred to the adjacent garage. Radiator ventilation intake and discharge air locations shall be separated to maintain the radiator ventilation intake air temperature below the maximum temperature allowed to meet the emergency and *legally required standby power system* loads.

[S][F] 2702.1.4 Load transfer. Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. ((~~Standby~~)) *Legally required standby power systems*

shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

[W][S][F] 2702.1.5 Load duration. Emergency power systems and *legally required standby power systems* shall be designed to provide the required power for a minimum duration of ((~~2~~)) 8 hours without being refueled or recharged, unless specified otherwise in this code.

Exception: The minimum duration of all required power loads may be reduced to 2 hours for all systems except for fire pumps that require a minimum duration of 8 hours in accordance with NFPA 20.

[F] 2702.1.6 Uninterruptable power source. An uninterrupted source of power shall be provided for equipment where required by the manufacturer's instructions, the listing, this code or applicable referenced standards.

[S][F] 2702.1.7 Interchangeability. Emergency power systems shall be an acceptable alternative for installations that require *legally required standby power systems*.

[F] 2702.1.8 Group I-2 occupancies. In Group I-2 occupancies located in *flood hazard areas* established in Section 1612.3, where new essential electrical systems are installed, and where new essential electrical system generators are installed, the systems and generators shall be located and installed in accordance with ASCE 24. Where connections for hookup of temporary generators are provided, the connections shall be located at or above the elevation required in ASCE 24.

[S][F] 2702.2 Where required. Emergency and *legally required standby power systems* shall be provided where required by Sections 2702.2.1 through 2702.2.19.

[F] 2702.2.1 Ambulatory care facilities. Essential electrical systems for *ambulatory care facilities* shall comply with Section 422.6.

[S][F] 2702.2.2 Elevators and platform lifts. ((~~Standby~~)) Legally required standby power shall be provided for elevators and platform lifts used as accessible *means of egress* as required in Sections 1009.4.1 ((~~,~~)) and 1009.5. ((~~, 3003.1, 3007.8 and 3008.8.~~)) Emergency power shall be provided for elevators in high-rise buildings as required in Section 403.4.8.4.

[S][F] 2702.2.3 Emergency responder communication coverage systems. ((~~Standby~~)) Legally required standby power shall be provided for in-building 2-way emergency responder communication coverage systems required in Section 918 and the *International Fire Code*. The legally required standby power supply shall be capable of operating the in-building ((~~2-way~~)) emergency responder communication ((~~coverage~~)) enhancement system at 100-percent system operation capacity for a duration of not less than 12 hours.

[S][F] 2702.2.4 Emergency voice/alarm communication systems. ((~~Standby~~)) For emergency voice/alarm communication systems per Section 907.5.2.2.5, legally required standby power shall be provided for emergency voice/alarm communication systems in accordance with NFPA 72.

[F] 2702.2.5 Exhaust systems. Standby power shall be provided for common exhaust systems for domestic kitchens located in multistory structures as required in Section 505.5 of the *International Mechanical Code*. Standby power shall be provided for common exhaust systems for clothes dryers located in multistory structures as required in Section 504.11 of the *International Mechanical Code* and Section 614.11 of the *International Fuel Gas Code*.

[F] 2702.2.6 Exit signs. Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] 2702.2.7 Gas detection system. Emergency or legally required standby power shall be provided for gas detection systems in accordance with the *International Fire Code*.

[F] 2702.2.8 Group I-2 occupancies. Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.11.

[F] 2702.2.9 Group I-3 occupancies. Emergency power shall be provided for *power-operated* doors and locks in Group I-3 occupancies as required in Section 408.4.2.

[S][F] 2702.2.10 Hazardous materials. Emergency or legally required standby power shall be provided in occupancies with hazardous materials where required by the *International Fire Code*.

[S][F] 2702.2.11 High-rise buildings. Emergency ((~~and standby~~)) power shall be provided in high-rise buildings as required in Section 403.4.8.

[S][F] 2702.2.12 Hydrogen fuel gas rooms. ((~~Standby~~)) Legally required standby power shall be provided for hydrogen fuel gas rooms as required by the *International Fire Code*.

[S][F] 2702.2.13 Laboratory suites. ((~~Standby~~)) Legally required standby or emergency power shall be provided in accordance with Section 5004.7 of the *International Fire Code* where *laboratory suites* are located above the sixth *story above grade plane* or located in a story below grade plane.

[F] 2702.2.14 Means of egress illumination. Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[S][F] 2702.2.15 Membrane structures. ((~~Standby~~)) Legally required standby power shall be provided for auxiliary inflation systems in permanent membrane structures as required in Section 3102.8.2. ((~~Standby~~)) Legally required standby power shall be provided for a duration of not less than 4 hours. Auxiliary inflation systems in temporary *air-supported* and air-inflated membrane structures shall be provided in accordance with Section 3103.10.4 of the *International Fire Code*.

[F] 2702.2.16 Semiconductor fabrication facilities. Emergency power shall be provided for semiconductor fabrication facilities as required in Section 415.11.11.

[S][F] 2702.2.17 Smoke control systems. ((~~Standby~~)) Emergency power shall be provided for smoke control systems as required in Sections 404.7, 909.11, 909.20.5.7, ((~~909.20.7.2~~)) and 909.21.5. *Legally required standby power systems* shall be provided for pressurization systems in low-rise buildings in accordance with Sections 909.20.6 and 909.21.5.

[F] 2702.2.18 Special purpose horizontal sliding, accordion or folding doors. ((~~Standby~~)) Legally required standby power shall be provided for special purpose horizontal sliding, accordion or folding doors as required in Section 1010.3.3. The legally required standby power supply shall have a capacity to operate not fewer than 50 closing cycles of the door.

[F] 2702.2.19 Underground buildings. Emergency ((~~and standby~~)) power shall be provided in underground buildings as required in Section 405.

[F] 2702.3 Critical circuits. Required critical circuits shall be protected using one of the following methods:

1. Cables, used for survivability of required critical circuits, that are listed in accordance with UL 2196 and have a *fire-resistance rating* of not less than 1 hour.
2. *Electrical circuit protective systems* having a *fire-resistance rating* of not less than 1 hour. *Electrical circuit protective systems* are installed in accordance with their listing requirements.
3. Construction having a *fire-resistance rating* of not less than 1 hour.

[S][F] 2702.4 Maintenance. Emergency and *legally required standby power systems* shall be maintained and tested in accordance with the *International Fire Code*.

CHAPTER 29
PLUMBING SYSTEMS

User note:

About this chapter: *Plumbing systems are another key element of any building. Chapter 29 provides the necessary number of plumbing fixtures, including water closets, lavatories, bathtubs and showers. The quality and design of each fixture must be in accordance with the* International Plumbing Code®.

SECTION 2901
GENERAL

[S][P] 2901.1 Scope. The provisions of this chapter and the ((~~*International*~~)) *Uniform Plumbing Code* shall govern the design, construction, erection and installation of plumbing components, appliances, equipment and systems used in *buildings* and structures covered by this code. Toilet and bathing rooms shall be constructed in accordance with Section 1210. ((~~Private sewage disposal systems shall conform to the *International Private Sewage Disposal Code*.~~)) The *International Fire Code*, ((~~the *International Property Maintenance Code*~~)) and the ((~~*International*~~)) *Uniform Plumbing Code* shall govern the use and maintenance of plumbing components, appliances, equipment and systems. The *International Existing Building Code* and the ((~~*International*~~)) *Uniform Plumbing Code* shall govern the alteration, *repair*, relocation, replacement and *addition* of plumbing components, *appliances*, *equipment* and systems.

Note: The Director of Public Health—Seattle and King County is authorized to enforce this chapter.

[W] 2901.2 Health codes. In food preparation, serving and related storage areas, additional fixture requirements may be dictated by state and local health codes.

[W] 2901.3 Fixed guideway transit and passenger rail systems. In construction of a fixed guideway and passenger rail system, subject to Section 3116, public plumbing fixtures are not required.

SECTION 2902
MINIMUM PLUMBING FACILITIES

[W][S][P] 2902.1 Minimum number of fixtures. Plumbing fixtures shall be provided in the minimum number as shown in Table 2902.1 based on the actual use of the building or space. Uses not shown in Table 2902.1 shall be ((~~considered~~)) determined individually by the ((~~code~~)) *building* official based on the classification and description which most nearly resemble the proposed use. The number of occupants shall be determined by this code.

Exception: Plumbing fixtures need not be provided for the following:

1. Buildings or facilities that are not normally occupied.
2. Storage, mechanical, electrical, and other similar spaces that are not normally occupied and are ancillary to the main occupancy of the building.
3. Building entry lobbies accessory to and used only for circulation in Group B office and Group R-2 residential occupancies.

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

[W][S][P] TABLE 2902.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS ((~~(URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)~~))		LAVATORIES		BATHTUBS/ SHOWERS	((~~DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)~~)	~~OTHER~~))
				Male	Female	Male	Female			
1	Assembly	A-1[d]	Theaters and other buildings for the performing arts and motion pictures[d]	1 per 125	1 per 65	1 per 200		—	((~~1 per 500~~	~~1 service sink~~))
		A-2[d]	Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d]	1 per 40	1 per 40	1 per 75		—	((~~1 per 500~~	~~1 service sink~~))
			Restaurants, banquet halls and food courts[d]	1 per 75	1 per 75	1 per 200		—	((~~1 per 500~~	~~1 service sink~~))
			((~~Casino gaming areas~~	~~1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400~~	~~1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400~~	~~1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750~~		—	~~1 per 1,000~~	~~1 service sink~~))
		A-3[d]	Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades, occupied roofs and gymnasiums[d]	1 per 125	1 per 65	1 per 200		—	((~~1 per 500~~	~~1 service sink~~))
			Passenger terminals and transportation facilities[d]	1 per 500	1 per 500	1 per 750		—	((~~1 per 1,000~~	~~1 service sink~~))
			Places of worship and other religious services[d]	1 per 150	1 per 75	1 per 200		—	((~~1 per 1,000~~	~~1 service sink~~))
		A-4	Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	((~~1 per 1,000~~	~~1 service sink~~))
		A-5	Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities ((~~f~~))	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	((~~1 per 1,000~~	~~1 service sink~~))

[W][S][P] TABLE 2902.1—continued
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS ((~~(URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)~~))		LAVATORIES		BATHTUBS/ SHOWERS	((~~DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)~~	~~OTHER~~))
				Male	Female	Male	Female			
2	Business	B	Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial, ((~~ambulatory care~~)) and similar uses	1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50		1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80		—	((~~1 per 100~~	~~1 service sink[e]~~))
3	Educational	E[e]	Educational facilities	1 per ((~~50~~)) 35	1 per 25	1 per 85	1 per 50	—	((~~1 per 100~~	~~1 service sink~~))
4	Factory and industrial	F-1 and F-2	Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials	1 per 100		1 per 100		((—)) See footnote g	((~~1 per 400~~	~~1 service sink~~))
5	Institutional	I-1	((~~Custodial~~)) Residential care facilities	1 per 10		1 per 10		1 per 8	((~~1 per 100~~	~~1 service sink~~))
		I-2	((~~Medical care recipients in hospitals and nursing homes~~)) Hospitals, ambulatory nursing home care recipient[b]	1 per room[c]		1 per room[c]		1 per 15	((~~1 per 100~~	~~1 service sink~~))
			Employees ((~~in hospitals and nursing homes~~)) other than residential care[b]	1 per 25		1 per 35		—	((~~1 per 100~~	~~—~~))
			Visitors ((~~in hospitals and nursing homes~~)) other than residential care	1 per 75		1 per 100		—	((~~1 per 500~~	~~—~~))
		I-3	Prisons[b]	1 per cell		1 per cell		1 per 15	((~~1 per 100~~	~~1 service sink~~))
			Reformatories, detention centers and correctional centers[b]	1 per 15		1 per 15		1 per 15	((~~1 per 100~~	~~1 service sink~~))
			Employees[b] ((~~in reformitories, detention centers and correctional centers[b]~~))	1 per 25		1 per 35		—	((~~1 per 100~~	~~—~~))
		I-4	Adult day care and child day care	1 per 15		1 per 15		1	((~~1 per 100~~	~~1 service sink~~))

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

[W][S][P] TABLE 2902.1—continued
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS ((~~URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE~~))		LAVATORIES		BATHTUBS/ SHOWERS	((~~DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE~~)	~~OTHER~~))
				Male	Female	Male	Female			
6	Mercantile	M	Retail stores, service stations, shops, salesrooms, markets and shopping centers	1 per 500		1 per 750		—	((~~1 per 1,000~~	~~1 service sink~~[e]))
7	Residential	R-1	Hotels, motels, boarding houses (transient)	1 per sleeping unit		1 per sleeping unit		1 per sleeping unit	((—	~~1 service sink~~))
		R-2	Dormitories, fraternities, sororities and boarding houses (not transient)	1 per 10		1 per 10		1 per 8	((~~1 per 100~~	~~1 service sink~~))
			Apartment house	1 per dwelling unit		1 per dwelling unit		1 per dwelling unit	((—	~~1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units~~))
		R-3	One- and two-family dwellings and lodging houses with five or fewer guestrooms	1 per dwelling unit		1 per 10		1 per dwelling unit	((—	~~1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit~~))
			Congregate living facilities with 16 or fewer persons	1 per 10		1 per 10		1 per 8	((~~1 per 100~~	~~1 service sink~~))
8	Storage	S-1 S-2	Structures for the storage of goods, warehouses, store-houses and freight depots, low and moderate hazard	1 per 100		1 per 100		((—)) See footnote g	((~~1 per 1,000~~	~~1 service sink~~))

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code, except with respect to Group E occupancies the provisions of note "e" shall apply.
b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.
c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.
d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.
e. ((~~For business and mercantile classifications with an occupant load of 15 or fewer, a service sink shall not be required.~~)) For Group E occupancies: the number of occupants shall be determined by using a calculation of 100 square feet gross building area per student for the minimum number of plumbing fixtures.

((~~f. The required number and type of plumbing fixtures for outdoor swimming pools shall be in accordance with Section 609 of the *International Swimming Pool and Spa Code*.~~))

g. See *Uniform Plumbing Code* Section 416 for installation requirements for emergency shower and eyewash equipment.

[P] 2902.1.1 Fixture calculations. To determine the *occupant load* of each sex, the total *occupant load* shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the *occupant load* of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers for each occupancy shall first be summed and then rounded up to the next whole number.

Exceptions:

1. The total *occupant load* shall not be required to be divided in half where approved statistical data indicates a distribution of the sexes of other than 50 percent of each sex.
2. Where multiple-user facilities are designed to serve all genders, the minimum fixture count shall be calculated 100 percent, based on total *occupant load*. In such multiple-user user facilities, each fixture type shall be in accordance with ICC A117.1 and each urinal that is provided shall be located in a stall.
3. Distribution of the sexes is not required where single-user water closets and bathing room fixtures are provided in accordance with Section 2902.1.2.

[W] 2902.1.1.1 Private offices. Fixtures only accessible to private offices shall not be counted to determine compliance with this section.

[W] 2902.1.1.2 Urinals in men's facilities. Where urinals in men's facilities are provided, one water closet less than the number specified may be provided for each urinal installed, except the number of water closets in such cases shall not be reduced to less than one-quarter (25%) of the minimum specified.

[W] 2902.1.1.3 Urinals in all-gender facilities. Where urinals are provided in all-gender facilities, one water closet less than the number specified may be provided for each urinal installed, except the number of water closets in such cases shall not be reduced less than one-quarter (25 percent) of the minimum specified.

[P] 2902.1.2 Single-user toilet and bathing room fixtures. The plumbing fixtures located in single-user toilet and bathing rooms, including family or assisted-use toilet and bathing rooms that are required by Section 1110.2.1, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by all persons regardless of their sex.

The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

[P] 2902.1.3 Lavatory distribution. Where two or more toilet rooms are provided for each sex, the required number of lavatories shall be distributed proportionately to the required number of water closets.

[W][S][P] 2902.2 Separate facilities. Where plumbing fixtures are required, separate facilities shall be provided for each sex.

Exceptions:

1. Separate facilities shall not be required for *dwelling units* and *sleeping units*.
2. Separate facilities shall not be required in structures or tenant spaces with a total *occupant load*, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile occupancies in which the maximum *occupant load* is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum *occupant load* is 25 or fewer.
5. Separate facilities shall not be required ((~~to be designated by sex where single-user toilets rooms~~)) when all-gender facilities are provided in accordance with Section ((~~2902.1.2~~)) 2902.2.2.
6. Separate facilities shall not be required where rooms having both water closets and lavatory fixtures are designed for use by both sexes and privacy for water closets are installed in accordance with Section ((~~405.3.4 of the *International Plumbing Code*~~)) 1210.3.1. Urinals shall be located in an area visually separated from the remainder of the facility or each urinal that is provided shall be located in a stall.
7. Separate facilities shall not be required in spaces primarily used for drinking or dining with a total occupant load, including both employees and customers, of 30 or fewer.

[P] 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities. Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 2902.4.

[W] 2902.2.2 All-gender facilities. All-gender toilet facilities, when provided, shall be in accordance with the following:

1. There is no reduction in the number of fixtures required to be provided for male and female in the type of occupancy and in the minimum number shown in Table 2902.1.
2. All-gender multiuser toilet rooms shall have water closets and urinals located in toilet compartments in accordance with ICC A117.1.
3. All-gender multiuser toilet room water closet and urinal compartments shall have full-height walls and a door enclosing the fixture to ensure privacy.
4. All-gender toilet room water closet and urinal compartment doors shall be securable from within the compartment.
5. All-gender toilet rooms provided for the use of multiple occupants, the egress door from the room shall not be lockable from the inside of the room.
6. Compartments shall not be required in a single-occupant toilet room with a lockable door.

[W][P] 2902.3 Employee and public toilet facilities. For structures and tenant spaces intended for public utilization, customers, patrons and visitors shall be provided with public toilet facilities. Employees associated with structures and tenant spaces shall be provided with toilet facilities. The number of plumbing fixtures located within the required toilet facilities shall be provided in accordance with Section 2902 for all users. Employee toilet facilities shall be either separate or combined employee and public toilet facilities.

Exception: Public toilet facilities shall not be required for:

1. Parking garages where operated without parking attendants.
2. Structures and tenant spaces intended for quick transactions, including takeout, pickup and drop-off, having a public access area less than or equal to 300 square feet (28 m^2).
3. Fixed guideway transit and passenger rail systems constructed in accordance with Section 3116.

[S][P] 2902.3.1 Access. The route to the public toilet facilities required by Section 2902.3 shall not pass through kitchens, food preparation areas, unpackaged food storage areas, storage rooms or closets. Access to the required facilities shall be from within the building or from the exterior of the building. Access to toilets serving multiple tenants shall be through a common use area and not through an area controlled by a tenant. The public shall have access to the required toilet facilities at all times that the building is occupied. For other requirements for plumbing facilities, see Chapter 11.

[P] 2902.3.2 Prohibited toilet room location. Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

[W][P] 2902.3.3 Location of toilet facilities in occupancies other than malls. In occupancies other than covered and *open mall buildings*, the required public and employee toilet facilities shall be located in each building not more than one *story* above or below the space required to be provided with toilet facilities, or conveniently in a building adjacent thereto on the same property, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

Exceptions:

1. The location and maximum distances of travel to required employee facilities in factory and industrial *occupancies* shall be permitted to exceed that required by this section, provided that the location and maximum distances of travel are *approved*.
2. The location and maximum distances of travel to required public and employee facilities in Group S *occupancies* shall be permitted to exceed that required by this section, provided that the location and maximum distances of travel are *approved*.

[P] 2902.3.4 Location of toilet facilities in malls. In covered and *open mall buildings*, the required public and employee toilet facilities shall be located not more than one *story* above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 m). In mall buildings, the required facilities shall be based on total square footage (m^2) within a *covered mall building* or within the perimeter line of an *open mall building*, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

[P] 2902.3.5 Pay facilities. Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

[P] 2902.3.6 Door locking. Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

[P] 2902.4 Signage. Required public facilities shall be provided with signs that designate the sex as required by Section 2902.2. Signs shall be readily visible and located near the entrance to each toilet facility. Signs for *accessible* toilet facilities shall comply with Section 1112.

[P] 2902.4.1 Directional signage. Directional signage indicating the route to the required public toilet facilities shall be posted in a lobby, corridor, aisle or similar space, such that the sign can be readily seen from the main entrance to the building or tenant space.

[W][P] 2902.5 Drinking fountain location. Drinking fountains shall not be required to be located in individual tenant spaces provided that public drinking fountains are located within a distance of travel of 500 feet (152 m) of the most remote location in the tenant space and not more than one story above or below the tenant space. Where the tenant space is in a covered or open mall, such distance shall not exceed 300 feet (91 m). Drinking fountains shall be located on an accessible route. Drinking fountains shall not be located in toilet rooms.

2902.5.1 Drinking fountain number. Occupant loads over 30 shall have one drinking fountain for the first 150 occupants, then one per each additional 500 occupants.

Exceptions:

1. Sporting facilities with concessions serving drinks shall have one drinking fountain for each 1,000 occupants.
2. A drinking fountain need not be provided in a drinking or dining establishment.

2902.5.2 Multistory buildings. Drinking fountains shall be provided on each floor having more than 30 occupants in schools, dormitories, auditoriums, theaters, offices and public buildings.

2902.5.3 Penal institutions. Penal institutions shall have one drinking fountain on each cell block floor and one on each exercise floor.

2902.5.4 Bottle filling stations. *Bottle filling stations* shall be provided in accordance with Sections 2902.5.4.1 through 2902.5.4.3.

2902.5.4.1 Group E occupancies. In Group E occupancies with an occupant load over 30, a minimum of one *bottle filling station* shall be provided on each floor. This *bottle filling station* may be integral to a drinking fountain.

2902.5.4.2 Substitution. In all occupancies that require more than two drinking fountains per floor or secured area, *bottle filling stations* shall be permitted to be substituted for up to 50 percent of the required number of drinking fountains.

2902.5.4.3 Accessibility. At least one of the required *bottle filling stations* shall be located in accordance with Section 309 of ICC A117.1.

[W][P] 2902.6 ((~~Small occupancies~~)) Not adopted. ((~~Drinking fountains shall not be required for an *occupant load* of 15 or fewer.~~))

[P] 2902.7 Service sink location. Service sinks shall not be required to be located in individual tenant spaces in a covered mall provided that service sinks are located within a distance of travel of 300 feet (91 m) of the most remote location in the tenant space and not more than one story above or below the tenant space. Service sinks shall be located on an *accessible route*.

[W] 2902.8 Dwelling units. Dwelling units shall be provided with a kitchen sink.

[W] 2902.9 Water. Each required sink, lavatory, bathtub and shower stall shall be equipped with hot and cold running water necessary for its normal operation.

[S] 2902.10 Water closet space requirements. The water closet stool in all occupancies shall be located in a clear space not less than 30 inches (762 mm) in width, with a clear space in front of the stool of not less than 24 inches (610 mm).

[P] 2903
INSTALLATION OF FIXTURES

[S] ((~~[P] 2903.1 Setting.~~ Fixtures shall be set level and in proper alignment with reference to adjacent walls.))

2903.1 Required. Plumbing fixtures shall be installed in accordance with the *Seattle Plumbing Code* and Chapter 12 of the *Seattle Building Code*.

((~~[P] 2903.1.1 Water closets, urinals, lavatories and bidets.~~ A water closet, urinal, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition, vanity or other obstruction. Where partitions or other obstructions do not separate adjacent fixtures, fixtures shall not be set closer than 30 inches (762 mm) center to center between adjacent fixtures. There shall be not less than a 21-inch (533 mm) clearance in front of a water closet, urinal, lavatory or bidet to any wall, fixture or door. Water closet compartments shall be not less than 30 inches (762 mm) in width and not less than 60 inches (1524 mm) in depth for floor-mounted water closets and not less than 30 inches (762 mm) in width and 56 inches (1422 mm) in depth for wall-hung water closets.~~

Exception: An accessible children's water closet shall be set not closer than 12 inches (305 mm) from its center to the required partition or to the wall on one side.

[P] 2903.1.2 Public lavatories. In employee and public toilet rooms, the required lavatory shall be located in the same room as the required water closet.

[P] 2903.1.3 Location of fixtures and piping. Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

[P] 2903.1.4 Water closet compartment. Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 housing areas.

[P] 2903.1.5 Urinal partitions. Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The horizontal dimension between walls or partitions at each urinal shall be not less than 30 inches (762 mm). The walls or partitions shall begin at a height not greater than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family/assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.))

CHAPTER 30
ELEVATORS AND CONVEYING SYSTEMS

Note: Chapter 30 is comprised entirely of Seattle amendments to the *International Building Code* and is not underlined. Where Seattle adopts and amends portions of standards, the underlining and striking out of text indicates changes from the language of the standard.

Large portions of the 2008 WAC 296-96, *Part D – Regulations for existing elevators, dumbwaiters, and escalators*, have been incorporated into Section 3011.

SECTION 3001
PURPOSE

The purpose of this chapter is to protect persons, buildings and the contents thereof from hazards arising from the use of elevators, dumbwaiters, material lifts, escalators, moving walks and other conveyances by establishing minimum requirements regulating the design, construction, alteration, operation, testing and maintenance of elevators, dumbwaiters, material lifts, escalators, moving walks and other conveyances, and by establishing procedures by which these requirements may be enforced.

SECTION 3002
SCOPE

3002.1 General. This code of safety standards covers the design, construction, installation, operation, inspection testing, maintenance, alteration and repair of elevators, dumbwaiters, material lifts, escalators, moving walks and other conveyances.

3002.2 Application to existing conveyances.

3002.2.1 Minimum standard for existing conveyances. All existing conveyances shall comply with Section 3011 as minimum standards.

3002.2.2 Maintenance. All conveyances covered under this chapter, both existing and new, and all parts thereof shall be maintained in a safe condition. All devices and safeguards that are required by this chapter shall be maintained in good working order. All devices or safeguards that were required by a code in effect when the conveyance was installed, altered, or repaired shall be maintained in good working order. Maintenance shall comply with ASME A17.1/CSA B44 Section 8.6. The owner or the owner's designated agent is responsible for the maintenance of such equipment.

3002.2.3 Repairs and replacements. Repairs to existing conveyances and replacements of devices and components shall be made with parts of at least equivalent material, strength and design. They shall comply with Section 3011 of this code and ASME A17.1/CSA B44 Section 8.6. The owner or the owner's designated agent is responsible for the repair and replacement of such equipment.

3002.2.4 Additions and alterations. Additions and alterations are permitted to be made to the conveyance system of *existing buildings* or structures without making the entire system comply with all of the requirements of this chapter for new buildings or structures, provided the additions and alterations that are made comply with the requirements of this chapter for a new system, except as otherwise specifically provided in this code and in other applicable retroactive ordinances of the city.

Unless otherwise *approved* by the *building official,* alterations, repairs, replacements, testing and maintenance of conveyances shall comply with the requirements of ASME A17.1/CSA B44 Section 8.7. Where Section 8.7 refers to a requirement that has been amended by this chapter, the requirements of this chapter take precedence. Alterations to existing material lifts shall conform with the requirements of WAC Chapter 296-96 Part C1 Standard Application Material Lifts or ASME A17.1/CSA B44, 7.4, or 7.5, or 7.6, where applicable. The owner or the owner's designated agent is responsible for additions and alterations of such equipment.

3002.2.5 Seismic improvements. The *building official* is authorized to promulgate rules to establish standards for seismic improvements to existing conveyances.

3002.2.6 Change of use. A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with Section 3011 of this code and Sections 8.7 and 2.16.4 of ASME A17.1/CSA B44 for passenger elevators.

3002.2.7 Landmark buildings and structures. See the *International Existing Building Code* for regulations regarding *landmark buildings* or structures.

3002.3 References to the *National Electrical Code.* For the purpose of this chapter, all references in the ASME Code to the *National Electrical Code* include the *Seattle Electrical Code.* All electrical work shall be done in accordance with the requirements of the *Seattle Electrical Code.*

3002.4 Conflicts. In any case where the codes adopted by reference in Section 3003 conflict with the requirements of this chapter, this chapter controls.

SECTION 3003
CODES

3003.1 Seattle Elevator Code. The following are adopted by reference as part of the *Seattle Building Code.* They also constitute the *Elevator Code* of the City of Seattle.

1. Safety Code for Elevators and Escalators, ASME A17.1-2019/CSA B44:19, as amended in this ordinance and Appendices A through D, F through J, L, M and P through V.

   Exceptions:

   1.1. ASME A17.1 Sections 5.8, 5.9, 5.10, 5.11, and 5.12 are not adopted.

   1.2. ASME A17.1 Section 1.2.1, Purpose, is not adopted.

2. Safety Standard for Platform Lifts and Stairway Chairlifts, ASME A18.1-2020.
3. Standard for Elevator Suspension, Compensation, and Governor Systems, ASME A17.6-2022.
4. Washington Administrative Code Chapter 296-96 Part C1 Minimum Standards for New and Altered WAC Material Lifts.
5. Washington Administrative Code Chapter 296-96 Private Residence Inclined Elevators, Section 24142 Guide rails, track supports and fastenings.

3003.2 Licensing. All persons and firms working on conveyances in Seattle shall comply with chapter 70.87 RCW and chapter 296-96 WAC.

3003.3 Administrative rules. The *building official* is authorized to adopt by administrative rule, in accordance with Section 104.8, that furthers the intent and purpose of this code, that encourages the use of state of the art technology, materials or methods of construction, and which provides standards that are equal or better than those contained in this code.

SECTION 3004
DEFINITIONS

The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein. These definitions are in addition to ASME A17.1/CSA B44 Section 1.3, RCW 70.87, Laws Governing Elevators and Other Lifting Devices, and Chapter 2 of this code.

ALTERATIONS, REPAIRS AND REPLACEMENTS. See ASME A17.1/CSA B44 Section 1.3.

AUTOMATIC ELEVATOR. A type of elevator that does not require an attendant. All calls are registered by the passengers.

CONTROL ROOM. An enclosed control space outside the hoistway, intended for full bodily entry, that contains the motor controller. The room could also contain electrical or mechanical equipment used directly in connection with the elevator, dumbwaiter, or material lift but not the electric driving machine or the hydraulic machine.

CONTROL SPACE. A space outside the hoistway, intended to be accessed with or without full bodily entry, that contains the motor controller. This space could also contain electrical or mechanical equipment used directly in connection with the elevator, dumbwaiter, or material lift but not the electric driving machine or the hydraulic machine.

CONVEYANCE. An elevator, accessibility lift, escalator, dumbwaiter, material lift, moving walk or other elevating device.

CONVEYANCES IN SERVICE. Units that are in operation, are inspected and certified by the *building official* for operation.

CONVEYANCES OUT OF SERVICE. The use of the unit has been prohibited either temporarily or permanently in accordance with Section 3005 below.

ELEVATOR GROUP. A grouping of elevators in a building located adjacent or directly across from one another that responds to common hall call buttons.

EMERGENCY OUT-OF-SERVICE ORDER. An emergency order issued by the *building official* removing a unit from service until corrections as identified in the order are made, and a passed inspection is resulted.

ENFORCING AUTHORITY. As used in ASME A17.1/CSA B44 means the *building official.*

EXISTING INSTALLATIONS. All conveyances that have been tested and approved for use by the *building official.*

INSPECTOR. Inspectors employed by the City of Seattle and working under the direction of the *building official.*

MACHINE ROOM. An enclosed machinery space outside the hoistway, intended for full bodily entry, that contains the electric driving machine or the hydraulic machine. The room could also contain the motor controller, and electrical and/or mechanical equipment used directly in connection with the elevator, dumbwaiter, or material lift.

MACHINERY SPACE. A space inside or outside the hoistway, intended to be accessed with or without full bodily entry, that contains elevator, dumbwaiter, or material lift mechanical equipment, and could also contain electrical equipment used directly in connection with the elevator, dumbwaiter, or material lift. This space could also contain the electric driving machine or the hydraulic machine.

WAC MATERIAL LIFT. A fixed, stationary conveyance used for freight transport in compliance with WAC 296-96-00700, Part C1, that:

1. Has a car or platform that moves in guides;
2. Serves two or more floors or landings of a building or structure;
3. Has a vertical rise of at least 30 inches (762 mm) and no more than 60 feet (18 288 mm);
4. Has a maximum speed of 50 feet (15 240 mm) per minute;
5. Is an isolated, self-contained lift and is not a part of a conveying system;
6. Travels in an inclined or vertical, but not horizontal, direction;
7. Is operated only by, or under the direct supervision of, an individual designated by the employer; and
8. Is installed in a commercial or industrial area, and not in an area that is open to access by the general public.

Note: WAC material lifts are not to be confused with Type A and Type B material lifts covered in ASME A17.1/CSA B44, Part 7)

SECTION 3005
AUTHORITY TO DISCONNECT UTILITIES, TAKE CONVEYANCES OUT OF SERVICE AND INVESTIGATE ACCIDENTS/INCIDENTS

3005.1 Disconnection of utilities. In addition to the provisions for Emergency Orders provided in Section 102, the *building official* is authorized to disconnect or order discontinuance of any utility service or energy supply to equipment regulated by this code in cases of emergency or where necessary for safety to life and property. Such utility service shall be discontinued until the equipment, appliances, devices or wiring found to be defective or defectively installed are replaced, repaired, or restored to a safe condition. Proper posting and seals shall be affixed to the equipment to prevent inadvertent use.

3005.2 Conveyances out of service. Conveyances taken out of service shall comply with Section 3005.2.

3005.2.1 Temporarily out of service. A conveyance shall be taken out of service temporarily after the *building official* has inspected the unit for proper parking of the car, securing the hoistway openings and disconnection of power, and has provided written approval to proceed. A seal and tag shall be placed on the equipment to insure against unauthorized use. Annual inspections shall be performed while the unit is in temporarily out of service status. It is unlawful to return a conveyance to service without approval of the building official. A conveyance is permitted to remain in a temporarily out of service status for a period not to exceed two years, after which time it shall be placed in a decommissioned status.

Exception: Elevators that could be returned to service without repair are allowed to remain in a temporary out-of-service status for more than two years with review and approval of the *building official*, and in accordance with 3005.2.4, Return to service.

3005.2.2 Decommissioning.

3005.2.2.1 Decommissioning a conveyance. A conveyance shall be decommissioned after the owner has applied for a decommissioning permit, and the *building official* has reviewed the building egress and has issued the decommissioning permit allowing the conveyance to be taken out of service. A licensed elevator mechanic working for a licensed elevator company shall decommission the conveyance according to ASME A17.1/CSA B44. The licensed elevator mechanic shall request an inspection of installation where the unit has power feed lines that have been disconnected from the mainline disconnect switch and, as applicable

(1) an electric elevator, dumbwaiter, or material lift or other conveyance whose suspension ropes have been removed from the hoistway, whose car and counterweight rest at the bottom of the hoistway, and whose hoistway doors have been permanently barricaded or sealed in the closed position on the hoistway side.

(2) a hydraulic elevator, dumbwaiter, or material lift whose car rests at the bottom of the hoistway; when provided with suspension means and counterweight, the suspension means have been removed from the hoistway and the counterweight rests at the bottom of the hoistway; whose pressure piping has been disassembled and a section removed from the premises and whose hoistway doors are permanently barricaded or sealed in the closed position on the hoistway side.

It is unlawful to return a conveyance to service without approval of the *building official*. Upon inspection and approval by the *building official*, annual inspections will no longer be required, until such time that the conveyance is returned to service.

3005.2.2.2 Decommissioning escalators and moving walks. An escalator or moving walk whose power feed lines have been disconnected from the mainline disconnect switch and with entrances that are permanently barricaded.

3005.2.2.3 Removing or dismantling a conveyance. Once the decommissioning process is completed, a *person* is not required to be an elevator contractor for removing or dismantling conveyances that are destroyed as a result of a complete demolition of a secured building or structure or where the building is demolished back to the basic support structure whereby no access is permitted therein to endanger the safety and welfare of a person.

3005.2.3 Emergency out-of-service order. Whenever the *building official* finds that any conveyance or portion thereof in an unsafe condition as to constitute an imminent hazard to life or limb, the *building official* may issue an emergency out-of-service order. The emergency order may

(1) direct that the conveyance or portion thereof be restored to a safe condition by a date certain;

(2) require that the conveyance or portion thereof be placed out of service within a reasonable period of time to be specified in the order.

3005.2.3.1 Service of emergency out-of-service order. The order shall be posted on the premises. The owner of the building or premises or any person responsible for the condition shall be notified of the order. The *building official* shall place a seal and lock on the service disconnect and leave a report of the condition at the time of the report and correction needed to restore safe operation. The *building official* shall specify the time for compliance.

3005.2.3.2 Effect of emergency out-of-service order. No person may use the conveyance or portion thereof, after the date on which the conveyance is placed out of service, until the conveyance or portion thereof is restored to a safe condition as required by the order and this code. It is a violation for any person to fail to comply with this or any emergency order issued by the *building official*.

3005.2.4 Return to service. Conveyances in an out-of-service status, either temporarily out of service, emergency out of service or decommissioned, are permitted to be placed back into service and classified as an existing installation unless determined to be hazardous by the *building official*. Requirements in effect at that time must be completed before certification and use. No installation or reconnection of hydraulic elevators powered by city water pressure is permitted. Prior to returning a temporarily out of service, emergency out of service or decommissioned conveyance to service all code required maintenance, examinations, category one testing and category five-year safety tests that are due shall be completed. The *building official* may witness safety tests. A permit shall be obtained, and an acceptance inspection shall be performed to the code in effect at the date of its original installation and/or alteration.

3005.3 Report and investigation of accidents. The owner or the owner's designated agent shall promptly notify the *building official* of each accident involving a conveyance that requires the service of a physician or results in a disability exceeding one day, and shall afford the *building official* every facility for investigating and inspecting the accident. The *building official* shall without delay, after being notified, make an inspection and shall place on file a full and complete report of the accident. The report shall give in detail all material facts and information available and the cause or causes, so far as they can be determined. The report shall be open to public inspection at all reasonable hours. If an accident involves the failure or destruction of any part of the construction or the operating mechanism of a conveyance, building structure, or building system that affects either the safety of building occupants or operation of the conveyance, the use of the conveyance is forbidden until the:

1. Conveyance has been made safe,
2. Proposed repairs or alterations have been approved by the *building official*,
3. Required permits have been issued by the *building official*, and the
4. Final inspection is completed.

The removal of any part of the damaged construction or operating mechanism from the premises is forbidden until the *building official* grants permission to do so.

3005.3.1 Report and investigation of incidents. The owner or the owner's designated agent shall promptly notify the *building official* of each incident involving a conveyance that results in the failure or destruction of any part of the construction or the operating mechanism of a conveyance, building structure, or building system that affects either the safety of building occupants or operation of the conveyance. The use of the conveyance is forbidden until the requirements listed in Section 3005.3 are satisfied. The investigating and inspecting of the incident will follow the same procedures as those for an accident as noted in Section 3005.3.

SECTION 3006
INSTALLATION AND ALTERATION PERMITS

3006.1 Installation permits. A permit issued by the *building official* is required to install any elevator, escalator, dumbwaiter, automobile parking elevator, material lift moving walk, accessibility lifts or other conveyance. A separate permit shall be obtained for each conveyance installed regardless of location and/or contract arrangements.

3006.2 Alteration/repair permits. A permit is required to make any alterations to existing elevators, escalators, dumbwaiters, material lifts, moving walks or other conveyances. A separate permit shall be obtained for each conveyance altered or relocated regardless of location and/or contract arrangements.

Exceptions:

1. Permits for repairs required by inspection reports are permitted to be combined for a single building.
2. The *building official* is permitted to issue a single permit for minor alterations to more than one conveyance that do not require individual retesting of each conveyance.
3. No permit shall be required for ordinary repairs made with parts of the same materials, strength and design normally necessary for maintenance.

3006.3 Temporary use permits for construction. The *building official* is permitted to issue a temporary use permit for a period not to exceed 60 days to allow completion of installation and passing of the final inspection. Temporary use permits may be renewed by the *building official*. If, at any time during the period of temporary use, the *building official* determines that the building owner is not making adequate progress toward completion of the installation and passing of the final inspection, the *building official* is permitted to withdraw the temporary use permit on seven days' notice. The *building official* is authorized to forbid further use of the conveyance until a certificate of inspection is obtained. If any conveyance is found to be *unsafe* or fails to comply with a notice of correction, the *building official* is authorized to revoke the temporary use permit.

1. The elevator shall be provided with an operator during all hours of elevator operation.
2. The elevator requires two-way communication between the car and elevator lobbies.

Note: See SDCI Tip 206A, Temporary Use Permit: Elevator Use During Construction Phase, for additional requirements for temporary use permits for construction.

3006.4 Expiration, renewal and revocation of permits. Sections 106.9 through 106.12 apply to permits required by this chapter.

SECTION 3007
PLANS AND SPECIFICATIONS

3007.1 Permit drawings. Two sets of drawings, which are permitted to be in an electronic format, shall be submitted with applications as determined by the *building official* for installations of new and altered elevators, escalators, dumbwaiters, material lifts, moving walks and other conveyances.

The drawings shall show beams, attachments, loads and reactions, and shall bear the seal of a structural engineer licensed under the laws of Washington State.

The *structural engineer in responsible charge* for the building shall review the drawings and forward them to the *building official* with a notation indicating that the drawings have been reviewed and been found to be in general conformance to the design of the building.

Exception: An engineer's stamp is not required for hydraulic elevators.

3007.1.1 Layout drawings. A set of legible layout/plans shall be submitted to the department. In addition to the layout criteria in ASME A17.1/CSA B44, 2.28.1 these shall include the following:

1. A machine/control room plan view drawing identifying room dimensions, location of drive machine, motor controller, mainline disconnect, light switch, and door swing (show clearances required in *Seattle Electrical Code* 110.26(A)(1);
2. A hoistway plan view identifying hoistway and conveyance equipment dimensions and clearances, footprint of car enclosure showing doors and inside net dimensions, location and dimensions of hoistway, and car door or gates;
3. A hoistway elevation view identifying elevation of the hoistway and conveyance equipment dimensions and clearances, the location of the pit ladder (distance from wall and width), pit light, light switch, pit stop switch, and top and bottom vertical car clearances. The height to the maintainable equipment at the top of the hoistway from the horizontal plane of the top of the car with the car positioned at the top landing shall be indicated on the hoistway elevation plans; and

4. Detail drawings identifying specific details of conveyance components: Rail bracket fastening, sill support and fastening, machine beams, entrance assembly detail (name, trademark, or file number), and additional seismic requirements (see ASME A17.1/CSA B44, Section 8.4 or 8.5 as applicable);
5. General conveyance data to include:
   (a) Conveyance type (e.g., electric, hydraulic, platform lift, etc.);
   (b) Rated capacity;
   (c) Building designation (e.g., Elev. #1, Car #2, etc.);
   (d) Rated speed;
   (e) Car enclosure (construction material);
   (f) Standoff panels (if applicable) (submit test data to ASTM E 84 if applicable);
   (g) Door type and manufacturer (single speed, two-speed, center opening, RH/LH opening);
   (h) Car and hall fixture detail;
   (i) Finish floor (tile, carpet) (submit test data to ASTM E 648 if applicable);
   (j) Power unit/drive motor (manufacturer and HP);
   (k) Equipment heat generation (BTU) (Elevator equipment and transformers where provided);

   Items (l) through (p) are applicable only to hydraulic elevators;
   (l) Jack assembly manufacturer;
   (m) Plunger O.D. (if telescoping O.D. of each section);
   (n) Plunger wall thickness;
   (o) Cylinder O.D.;
   (p) Cylinder wall thickness (items (q) through (u) are applicable to roped-hydraulic and/or electric elevators);
   (q) Size and number of suspension means;
   (r) Roping type (1:1, 2:1, underslung);
   (s) Governor location;
   (t) Governor rope size and type;
   (u) Safety manufacturer and type;
   (v) Emergency brake manufacturer and type;
   (w) Car buffer type and stroke;
   (x) CWT buffer type, impact, and stroke; and
   (y) Designed top/bottom runby.
6. The installation of a conveyance shall not begin until an approved set of plans and permit has been issued by the department.
7. The stamped approved plans and permit shall be posted on the job site during the installation and up to the time the conveyance has passed an acceptance inspection.
8. Where structural elements are part of any installation, relocation, or alteration, the plans shall be reviewed and stamped by a professional engineer, registered in the state of Washington.
9. For alteration/modernization permits, provide documentation per the scope of work, per ASME A17.1/CSA B44, 8.7.
10. For Cosmetic alteration only permits, provide a weight differential letter containing the total weight of items removed, added, and the resulting percent of differential to the original designed cab weight.

3007.2 Amendments to the permit. If changes to the *approved* work are made during construction, approval of the *building official* shall be obtained prior to execution. The inspector may approve minor changes for work that will not reduce the structural strength or fire and life safety of the structure. The inspector shall determine if it is necessary to revise the *approved construction documents.* No changes that are subject to special inspection required by Chapter 17 shall be made during construction unless approved by the *building official.* If revised plans are required, changes shall be shown on two sets of plans, permitted to be in electronic format, that shall be submitted to and approved by the *building official*, accompanied by fees specified in the *Fee Subtitle* prior to occupancy. All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits.

SECTION 3008
REQUIRED INSTALLATION INSPECTIONS

3008.1 Installation inspections. It is the duty of the person doing the work authorized by a permit to notify the *building official* that such work is ready for inspection.

It is the duty of the person requesting any inspections required by this chapter to provide access to and means for proper inspection of such work.

Final inspection shall be called for by the applicant when the work described on the permit has been completed, and when ready for testing with weights and instruments, as needed. A final inspection is required after all wiring has been completed and all permanent fixtures such as switches, outlet receptacles, plates, lighting fixtures and all other equipment has been properly installed, and the hoistway, control rooms, spaces are properly completed.

SECTION 3009
CERTIFICATES OF INSPECTION AND OPERATION

3009.1 Certificates required. It is a violation of this code to operate any elevator, escalator, dumbwaiter, material lift, moving walk or other conveyance without a certificate of inspection or authorization of temporary use issued by the *building official.* A certificate of inspection shall be issued following an inspection by the *building official* showing that the conveyance has been found to be in safe operating condition and applicable fees for inspection time, as set forth in the *Fee Subtitle,* have been paid. The certificate is valid until 45 days after the next inspection or until the certificate is withdrawn, whichever comes first.

The certificate of inspection shall be posted in the machine room, control room or management office.

If any conveyance is found to be *unsafe* or fails to comply with a notice of correction, the *building official* is authorized to withdraw the certificate of inspection.

3009.2 Periodic inspections. The *building official* shall cause inspections to be made of every conveyance at intervals of 12 months or as soon thereafter as is practical. The inspector shall file a full and correct report on each conveyance with the *building official* that shall note any code violations, corrections required and the general condition of the conveyance.

3009.3 Inspection report by building official. After each required inspection of a conveyance the *building official* shall mail a copy of the inspection report to the owner of the conveyance inspected. If inspection shows a conveyance to be in violation of the requirements of this chapter, the *building official* shall issue a notice in writing listing the corrections to be made to the conveyance that are necessary to bring it into compliance with this chapter and is authorized to order the operation thereof discontinued until the corrections are made.

The owner upon upload of inspection report shall complete all corrections within 90 days. The owner or owner's authorized agent shall notify the *building official* in writing when deficiencies are corrected.

3009.4 Inspections, tests, and test reports. Reports of required tests shall be submitted to the owner and to the *building official* on forms furnished by the *building official.* Reports shall be submitted to the *building official* in writing within 60 days of completion of tests. Performance of required tests and their cost shall be the responsibility of the owner. Identification of conveyances shall be noted by use of assigned city numbers.

SECTION 3010
REQUIREMENTS FOR OPERATION AND MAINTENANCE

3010.1 Responsibility for operation and maintenance. The owner or the owner's designated agent is responsible for the safe operation and maintenance of each device regulated by this chapter. The installation of pipes, ducts, conduits, wiring and the storage of materials not required for the operation of the elevator is prohibited in hoistways, control rooms, machine rooms and machine spaces. Sidewalk elevators in public places are also subject to the requirements of Title 15, Seattle Municipal Code, Street and Sidewalk Use, as amended. See Section 5.5 of ASME A17.1/CSA B44 for requirements for operation and maintenance.

SECTION 3011
RETROACTIVE REQUIREMENTS FOR EXISTING INSTALLATIONS

3011.1 Scope. Existing electric elevators, direct plunger and roped hydraulic elevators, escalators, electric and hand-powered dumbwaiters, hand-powered elevators and other conveyances shall comply with the provisions of this section.

3011.2 Key boxes and keys required. Key retainer boxes and keys shall be provided for all conveyances.

3011.3 Key retainer box compliance. The key retainer box shall comply with Section 3011.3.1 or 3011.3.2.

3011.3.1 Conveyances installed between March 1, 1956 and August 14, 2004. A key retainer box locked and keyed to the standard City access key for elevator access and operation keys shall be provided. The key retainer box shall meet the following standards:

1. Dimensions – 8 inches high, 6 inches wide, 1 inch deep.
2. Material – 16 gauge steel welded.
3. Color – red (unless located in the main lobby above the hall call button, 6 feet nominal above the floor).
4. Labeling – "FOR FIRE DEPARTMENT USE."
5. Lock – Ace one-inch cylinder cam lock key #39504.

The key retainer box is to be installed at the designated recall floor above the Phase I recall switch or in the main lobby above the hall call button when no recall feature exists. The key retainer box is to be mounted 6 feet nominal above the floor. The *building official* is permitted to approve other locations upon request.

Key retainer boxes are permitted to comply with Section 3011.3.2 or 3016.12 as an alternative to complying with this section.

3011.3.2 Conveyances installed between August 15, 2004 through November 5, 2016. A key retainer box locked and keyed to the secure city access key for elevator and other conveyance access and operation keys shall be provided. The key retainer box shall meet the following standards:

1. Minimum dimensions – 6-1/2 inches high, 6 inches wide, 2 inches deep.
2. Material – at least 16 gauge steel welded.
3. Color – red (unless located in the main lobby above the hall call button, 6 feet above the floor).
4. Labeling – "For Emergency Use".
5. Lock – high security Medeco lock specified by the *building official.* Use of the key shall be restricted to fire, emergency response and elevator inspection personnel.

The key retainer box shall be flush or surface mounted, installed at the designated recall floor above the Phase I recall switch or in the main lobby above the hall call button if no recall feature exists. The key retainer box is to be mounted approximately 6 feet above the floor. The key retainer box shall be attached to the building so as to be able to withstand a force of 300 lbf/square foot applied horizontally at any point. In buildings with more than one elevator, the key retainer box shall be large enough to accommodate all required keys. The building official may approve other locations and custom box types upon request.

Key retainer boxes are permitted to comply with Section 3016.12 as an alternative to complying with this section.

3011.4 Elevator access keys. Keys for access to and for the operation of elevating equipment shall be tagged and retained in the key retainer box. The key retainer box shall contain fire emergency service keys (Phase I and II, one key for each switch) and keys for any of the following that are in the building:

1. Doors to the control room, machine room and machine space;
2. Secondary level door;
3. Pit door;
4. Roof door;
5. Independent, hospital emergency and/or attendant operation;
6. Hoistway access;
7. Mechanical hoistway access devices (broken arm, lunar, etc.);
8. Miscellaneous switches with locks;
9. Fire alarm panel room;
10. Sprinkler valve control room.

3011.5 Hoistways and related construction for electric and hydraulic elevators. This section shall apply to all electric and hydraulic elevators.

3011.5.1 Hoistways.

3011.5.1.1 Hoistways enclosures.

1. Fire-resistive requirements found in the Seattle Building and Fire Codes apply to hoistway enclosures.
2. Where doors and hoistway enclosures are not required to be fire resistant, the hoistway shall be enclosed:
   2.1. With material, which may be solid or with openings that will reject a 1/2-inch diameter ball;
   2.2. To a height of 6 feet above each floor or landing and above the treads of adjacent stairways.
3. Enclosures shall be supported and braced as to deflect not over one inch when subjected to a 100 pound force perpendicularly applied at any point.

4. Enclosures adjacent to the counterweights shall extend the full height of the floor and extend 6 inches past the counterweight raceway.

3011.5.1.2 Windows in hoistway enclosures.

1. Guards are required on outside hoistway windows if the windows are located:
   1.1. Ten stories or less above a thoroughfare; or
   1.2. Three stories or less above the roof of an adjacent building.
2. Hoistway windows can be guarded by one of the following methods:
   2.1. By vertical bars at least 5/8 inch in diameter or equivalent, spaced no more than 10 inches apart, permanently and securely fastened in place; and
   2.2. By metal-sash windows having solid section steel muntins of no less than 1/8 thickness spaced no more than 8 inches apart.
3. Exterior hoistway windows shall be identified with 4-inch-high letters marked "Elevator."

3011.5.1.3 Pipes conveying gases, vapors, or liquids in hoistways.

1. All steam and hot water pipes in hoistway shall be covered to prevent direct spray onto the elevator car if ruptured to comply with ASME A17.1, Rule 102.2 1990.
2. All other pipes or ducts currently in the hoistway shall be securely fastened to prevent excessive vibration.
3. No future pipes or ducts may be installed in the hoistway unless they directly pertain to the operation of the elevator.

3011.5.1.4 Access for maintenance and inspection.

1. Overhead sheave spaces requiring inspection and maintenance shall be provided with suitable access and decking to provide a safe space for personnel.
2. Guardrails shall be installed where decking does not cover the complete hoistway.
3. Guardrail and deck supports shall be similar to those required for the top of the elevator car and may be made of either wood or metal compatible with the existing hoistway construction.
4. Inspections and maintenance may be performed from the top of an elevator car if a ladder is not required to perform these functions.

3011.5.1.5 Car top guard railings. A standard railing shall be installed on the top of all elevators in compliance with ASME A17.1/CSA B44, 2.14.1.7. Where existing conditions do not permit the railing to be installed according to clearances of 2.14.1.7.2, the following shall apply:

1. The top railing shall be installed at a height of not less than 1070 mm (42 in.) nor more than 1100 mm (43 in.) from the car top.
2. Where overhead conditions prevent the top railing from being located between 1070 mm (42 in.) and 1100 mm (43 in.), the railing shall be permitted to be lowered to a height that still provides the minimum of 100 mm (4 in.) vertical clearance to the nearest overhead object. In such cases the top railing shall be provided with red and white stripes 50 mm (2 in.) in width.
3. The stripes are only required on the side(s) where the top rail is below 900 mm (35 in.).
4. Where required, the stripes shall extend the entire length of the top rail.
5. Where the overhead conditions prevent the railing from complying with the vertical height and/or the clearances in ASME A17.1/CSA B44, 2.14.1.7.2(a) or (b), provide signage as required by 3011.5.1.6.
6. Toeboards are not required.

3011.5.1.6 Signage requirements for traction elevators with minimal overhead clearances.

1. Elevators that do not have a minimum of 24 inches of clearance from the crosshead, or any equipment mounted on the crosshead, to the lowest member of the overhead structure in the hoistway when the car has reached its maximum upward movement shall have signage. A sign shall be located near the top of car inspection station. An additional sign shall be posted on the hoistway wall. This sign shall be visible when accessing the car top. The sign shall consist of alternating 4-inch diagonal red and white stripes and shall clearly state "danger low clearance" in lettering not less than 4 inches in height.
2. Where required by 3011.5.1.5, a sign shall be provided that reads: "Caution: Low Clearances Above Guardrail."

3011.5.2 Machine rooms and machinery spaces.

3011.5.2.1 Doors to elevator and dumbwaiter machine rooms and machinery spaces. Doors to elevator and dumbwaiter machine rooms, control rooms and machinery spaces shall be self-closing and self-locking. The lock shall be a

spring-type lock arranged to permit the door to be opened from the inside without a key, incapable of being left in the unlocked position, and accessible only by a key from the outside.

3011.5.2.2 Machine rooms and machinery spaces: lighting and receptacles.

1. Provide and maintain a clear, permanent and safe means of access to machine rooms and machinery spaces.
2. Permanent electric lighting shall be provided in all machine rooms and machinery spaces. The illumination shall be not less than 10 foot-candles (108 lux) at the floor level on installations prior to August 15, 2004. The lighting control switch shall be located within easy reach of the access to the room or space. Where practicable, the control switch shall be located on the lock-jamb side of the access door.
3. Where provided, duplex and simplex receptacles for machine rooms and machinery spaces shall be permanently grounded.
4. Provide a sign on the elevator machine room door in 1 inch high stating Elevator Machine Room.

3011.5.2.3 Pipes conveying gases, vapors, or liquids in machine rooms and machinery spaces.

1. Pipes conveying gases, vapors or liquids are not permitted to be installed in machinery spaces, machine rooms and control rooms unless necessary for operation or maintenance of the elevator and not used for any other purpose.
2. All other pipes or ducts currently in the machine rooms and machinery spaces shall be securely fastened to prevent excessive vibration.
3. No future pipes or ducts shall be installed in the machine rooms and machinery spaces.

3011.5.2.4 Protection from weather. Elevator machines and control equipment shall be protected from the weather.

3011.5.2.5 Guards. In hoistways, machine rooms and machinery spaces.

1. Where feasible, gears, sprockets, sheaves, cables, tapes, belts and chains shall be fitted with suitable guards to prevent accidental contact.
2. Openings in machine room floors above the hoistway shall be guarded to prevent tools from falling into the hoistway below.
3. Open grating in machine room floors shall reject a ball 1/2 inch in diameter.
4. Ventilation grids where exposed to the hoistway below shall be firmly fastened to prevent accidental removal and shall be fitted with 1/2 inch wire mesh under the grid.

* **3011.5.2.6 Anchorage for elevator equipment.** All elevator equipment, hydraulic or cable type shall be anchored.

3011.5.3 Pits.

3011.5.3.1 Access to pits.

1. A safe means of access for authorized personnel shall be provided to all pits.
2. Access doors, if provided, shall be kept closed and locked.
3. Access ladders shall be installed in elevator pits 3 feet or deeper.

Where constraints prohibit the installation of a pit ladder, a retractable ladder shall be permitted to be installed in accordance with 2.2.4.2.7 and 2.2.4.2.8 of ASME A17.1/CSA B44-2019.

3011.5.3.2 Drains.

1. Pit drains connected directly to sewers are prohibited.
2. Sumps, with or without pumps, are permitted.

3011.5.3.3 Illumination of pits. For installations prior to August 15, 2004, a permanent lighting fixture shall be provided in all pits which shall provide an illumination of not less than 5 foot-candles at the pit floor. A light switch shall be provided inside the hoistway and be so located as to be accessible from the pit access door and adjacent to the pit ladder if provided. Light bulbs shall be guarded to prevent contact and accidental breakage. A permanent grounded outlet shall be provided in all pits.

3011.5.3.4 Counterweight pit guards.

1. Where feasible, unperforated metal guards shall be installed in the pit on the open side, or sides, on all counterweights where spring or solid-type buffers are used or where oil buffers attached to the counterweight are used.

   Exception: Where compensating chains or ropes are attached to the counterweight the guard may be omitted on the side facing the elevator or to which the chains or ropes are attached.
2. Guards shall extend from a point not more than 12 inches above the pit floor to a point not less than 7 feet nor more than 8 feet above such floor; and be fastened to a metal frame properly reinforced and braced to be at least equal in strength and stiffness to a No. 14 U.S. gauge sheet steel.

3011.5.4 Protection of space below hoistways.

3011.5.4.1 Spaces below hoistways. Where the space below the hoistway is not permanently secured against access, the following requirements shall be conformed to:

1. Counterweights shall be provided with safeties.
2. The cars and counterweight shall be provided with spring or oil buffers.
3. Car and counterweight buffer supports shall be of sufficient strength to withstand, without permanent deformation, the impact resulting from buffer engagement at the following speeds.
4. Governor tripping speed where the safety is governor operated.
5. 125% of the rated speed where the safety is not governor operated.

3011.5.5 Hoistway entrances.

3011.5.5.1 Doors or gates required.

1. Passenger elevators. Hoistway landing openings for passenger elevators shall be provided with entrances which guard the full width and height of the openings. The panels of entrances used with automatic-operation passenger elevators shall have no hand latches or other hand operated door fastening devices, nor shall such panels;
2. Freight Elevators. Hoistway landing openings for freight elevators shall be provided with entrances which guard the full width of the opening. Gates and doors shall conform to the following requirements:
   - 2.1. Balanced type vertically sliding hoistway gates shall extend from a point not more than 2 inches from the landing threshold to a point not less than 66 inches above the landing threshold.
   - 2.2. Gates shall be solid or shall be openwork of a design to reject a 2 inches in diameter ball and be located so that the distance from the hoistway face of the gate to the hoistway edge of the landing sill is no more than 2-1/2 inches.
   - 2.3. Gates shall be constructed of metal or wood and shall be so designed and guided that they will withstand a lateral pressure of 100 pounds applied at approximately their center without breaking or being permanently deformed and without displacing the gate from its guides or tacks.
   - 2.4. At the top landing, a gate 66 inches (1.65 M) high may be used if there is not sufficient clearance for a 6 foot (1.83 m) high gate. When the requirements of 3011.5.1.1 allow nonfire-resistive hoistway enclosures, a gate may be used.
   - 2.5. Gates shall be constructed of either metal or wood.
   - 2.6. Gates shall withstand a lateral pressure of 100 pounds, applied at approximately their center, without braking, be permanently deformed of be displaced from their guides or tracks.
   - 2.7. The maximum vertical opening between a landing sill and a door or gates is 2 inches.
   - 2.8. The distance between the gate's hoistway face and the hoistway landing edge shall not exceed 2-1/2 inches.

3011.5.5.2 Closing of hoistway doors.

1. Horizontally sliding doors of automatic-operation elevators shall be provided with door closers arranged to close an open door automatically if the car for any reason leaves the landing zone.
2. Horizontal swinging single or center-opening doors of automatic-operation elevators shall be self-closing.
3. Door closers are not required for the swinging portion of combination horizontally sliding and swinging doors
4. On center-opening doors that utilize relating cables if the cabling fails or when the cabling is replaced, a method shall be provided to ensure that both doors automatically close if the car for any reason leaves the landing zone.

3011.5.5.3 Hoistway door vision panels.

1. Manually operated or self-closing doors of the vertically or horizontally sliding type, for elevators with automatic or continuous-pressure operation, shall be provided with a vision panel except at landings of automatic-operation elevators where a hall position indicator is provided.
2. In multisection doors, the vision panel is required in one section only, but may be placed in all sections.
3. All horizontally swinging doors shall be provided for with vision panels.
4. Vision panels may be provided for any type of hoistway door regardless of the type of operation of the elevator. Where provided, vision panel shall meet the following requirements:
   - 4.1. The area of any single vision panel shall be at least 25 square inches, with the total area of one or more vision panels in any hoistway door shall be not more than 80 square inches.
   - 4.2. Each clear panel opening shall reject a ball 6 inches (152 mm) in diameter.

4.3. Muntins between panel sections shall be of noncombustible material and of substantial construction. If located on the landing side, they shall be flush with the surface of the landing side of the door.

4.4. Panel openings shall be glazed with clear wire glass not less than 1/4 inch (6.3 mm) thick.

4.5. A panels center shall be located not less than 54 inches (1.37 m) but nor more than 66 inches (1.68 m) above the landing except, that for vertically sliding, biparting counterbalanced doors, it shall be located to conform with the dimensions specified to the extent that the door design will permit.

4.6. The vision panels in horizontally swing doors shall be located for convenient vision when opening the door from the car side.

4.7. Wire-glass panels in power-operated doors shall be substantially flush with the surface of the landing side of the door.

4.8. Vision panel frames shall be secured by means of nonreversible screws or other tamper proof fasteners.

4.9. Vision panels which do not meet the requirements of subsections 4.1 through 4.8 of this section shall be protected by protective grilles made of number 15 gauge stainless or galvanized steel in accordance with the following specifications.

(i) Grilles shall be sized to fit within or over the vision panel frame and completely cover the vision panel opening in the hoistway door.

(ii) Grilles shall be secured by means of nonreversible screws or other tamper-proof fasteners.

(iii) Grilles shall contain openings which shall not be larger than 3 inches (19.1 mm) by 3/4 inches (19.1 mm) or 3 inches (19.1 mm) in diameter.

(iv) All edges shall be beveled and free of burrs.

(v) Grilles shall be installed on the hoistway side of the door.

3011.5.5.4 Door hangers. Door hangers for horizontal slide type entrances shall conform to the following:

1. Means shall be provided to prevent the hangers from jumping the track.
2. Stops shall be provided in the entrance assembly to prevent hangers from overrunning the end of the track.
3. Power-operated doors shall be constructed to withstand, without damage or appreciable deflection, an imposed static load equal to four times the weight of each panel as applied successively downward and upward at the vertical centerline of the panel.

3011.5.5.5 Nonshearing astragals. On a vertically sliding, biparting, counterbalanced hoistway door, a fire-resistive, nonshearing, an noncrushing member of either the meeting or overlapping type shall be provided on the upper panel to close the distance between the rigid door sections when in contact with the stops. Rigid members which overlap the meeting edge, and center-latching devices are prohibited.

3011.5.5.6 Pull straps. Manually operated vertical slide biparting elevators doors which can be operated from the landings shall be provided with pull straps on the inside and outside of the upper panel where the lower edge of the upper panel is more than 6 feet 6 inches (1.98 m) above the landing when the panel is in the fully open position. The length of the pull straps shall be as follows:

1. The bottom of the strap shall be not more than 6 feet 6 inches (1.98 m) above the landing when the panel is in the fully opened position.
2. The length of the strap shall not be extended by means of ropes or other materials.
3. Where pull straps are provided on the car side of doors of elevators which can be operated from the car only, the length of the pull straps shall conform to the requirements specified in 1 and 2 of this section.

3011.5.5.7 Landing sill clearances. The clearance between the car-platform sill and the hoistway edge of any landing sill, or the hoistway side of any vertically sliding counterweighted, or of any vertically sliding counterbalanced biparting hoistway door, shall be:

1. At least 1/2 inch (13 mm) where side car guides are used.
2. At least 3/4 inch (19 mm) where corner car guides are used.
3. In all cases the maximum clearance shall be not more than 1-1/2 inch (38 mm).

3011.5.5.8 Threshold clearance. The maximum dimension from the hoistway door or gate face to the hoistway edge of the threshold shall not exceed 2-1/4 inches.

3011.5.5.9 Floor number. Elevator hoistways shall have floor numbers, not less than 2 inches high, placed on the walls and/or doors of hoistways.

3011.5.5.10 Additional doors other than hoistway and car doors installed between January 1992 and November 5, 2016. Doors other than the hoistway door and the elevator car door are prohibited at the point of access to or from an elevator car.

Exception: Doors that are readily openable from the car side without a key, tool, or special knowledge or effort.

3011.5.6 Hoistway door locking devices, parking devices, and access.

3011.5.6.1 Hoistway door or gate locking devices.

1. Hoistway doors or gates for passenger elevators shall be equipped with hoistway-unit system hoistway-door interlocks.
2. Hoistway doors or gates for freight elevators shall be equipped with hoistway-unit system hoistway-door interlocks, or an approved type combination electric contact and mechanical lock.
3. Combination locks and electric contacts, or interlocks shall be so located that they are not accessible from the landing side when the hoistway doors or gates are closed.

3011.5.6.2 Elevator parking devices.

1. Elevators that are operated from within the car only, shall have elevator parking devices installed at every landing that is equipped with an unlocking device.
2. On elevators that are not operated from within the car only, a parking device shall be provided at one landing and may be provided at other landings. This device shall be located at a height not greater than 6 feet 11 inches (2.11 m) above the floor.
3. Parking devices are not required for elevators having hoistway doors that are automatically unlocked when the car is within the landing zone.
4. Parking devices shall conform to the following specifications:
    4.1. They shall be mechanically or electrically operated.
    4.2. They shall be designed and installed so that friction or sticking or the breaking of any springs used in the device will not permit opening or unlocking a door when the car is outside the landing zone of that floor.
    4.3. Where springs are used, they shall be of the restrained compression type which will prevent separation of the parts in case the spring breaks.

3011.5.6.3 Access to hoistway. Hoistway door unlocking devices or hoistway access switches shall be provided on all elevators at the upper landing to permit access to the top of the car and at the lowest landing if this landing is the normal point of access to the pit. Hoistway door unlocking devices may be provided at all landings for emergency purposes.

1. Hoistway door unlocking devices. Hoistway door unlocking devices shall conform to the following:
    1.1. The device shall unlock and permit the opening of the hoistway door from the access landing irrespective of the position of the car.
    1.2. The devices shall be designed to prevent unlocking the door with common tools.
    1.3. The operating means for unlocking the door shall be available to and used only by inspectors, elevator maintenance and repair personnel, and qualified emergency personnel.
    1.4. The unlocking-device keyway shall be located at a height no greater than 6 feet 11 inches above the floor.
2. Hoistway access switches. Hoistway access switches shall conform to the following:
    2.1. The switch shall be installed only at the access landings.
    2.2. The switch shall be installed adjacent to hoistway entrance at the access landing with which it is identified.
    2.3. The switch shall be of the continuous-pressure spring-return type, and shall be operated by a cylinder-type lock having not less than five-pin or five-disk combination with the key removable only when the switch is in the "off" position. The lock shall not be operable by any key which will operate locks or devices used for other purposes in the building. The key or combination shall be available to and used only by inspectors and elevator maintenance and repair personnel.
    2.4. The operation of the switch at either access landing shall permit, and may initiate and maintain, movement of the car with the hoistway door at this landing unlocked or not in the closed position, and with the car door or gate not in the closed position, subject to the following:
        (i) The operation of the switch shall not render ineffective the hoistway door interlock or electric contact at any other landing.
        (ii) The car cannot be operated at a speed greater than 150 fpm (0.76 m/s).

(iii) For automatic and continuous-pressure operation elevators, provided: Landing operating devices of continuous-pressure operation elevators, and car and landing operating devices of automatic operation elevators shall first be made inoperative by means other than the access switch; and power operation of the hoistway door and/or car door or gate is inoperative.

(iv) Automatic operation by a car-leveling device is inoperative.

(v) The top-of-car operating device is inoperative.

(vi) The movement of the car initiated and maintained by the upper access switch shall be limited in the down direction to a gravel not greater than the height of the car crosshead above the car platform, and limited in the up direction above the upper access landing to the distance the car apron extends below the car platform. Where electronically operated switches, relays, or contactors are used to render inoperative the hoistway-door interlock or electric contact or the car door or gate electric contact, the control circuits shall be arranged to conform to the requirements of 3011.6.3.5 and in addition, to render the normal car and hall operation ineffective if any such switch, relay, or contactor fails to function in the intended manner.

3011.5.7 Power operation of doors and gates.

3011.5.7.1 Reopening device for power-operated car doors or gates.

1. Where required a power-operated car door or gate shall be provided with a reopening device which will function to stop and reopen the car door or gate and the adjacent hoistway door in the event that the car door or gate is obstructed while closing. If the closing kinetic energy is reduced to a 2-1/2-ft-lbf (3.39 J) or less, the reopening device shall be rendered inoperative.
2. For center-opening doors or gates, the reopening device shall be so designed and installed that the obstruction of either door or gate panel when closing will cause the reopening device to function.

3011.5.7.2 Photo electric or electric eye devices. An elevator equipped with a photo electric or electric eye device for reopening of the car and hoistway doors shall be provided with a means that will automatically time-out and close the door if it has been obstructed for 20 seconds. The photo electric or electric eye device shall not be reestablished until the doors have fully closed. There are two exceptions to this requirement:

Exceptions:

1. The *building official* may authorize hospital or nursing homes to allow obstructed doors to close within 35 seconds after the expiration of the normal door open time.
2. When smoke detectors are used to bypass photo electric or electric eye devices, the doors are not required to time-out and close except under Phase I conditions in accordance

3011.6 Machinery and equipment for electric elevators.

3011.6.1 Scope. This section is a minimum standard for all existing electric elevators. It applies to other equipment only as referenced in the applicable part.

3011.6.1.1 Buffers and bumpers. Car and counterweight buffers or bumpers shall be provided. Solid bumpers may be used in lieu of buffers:

1. Where the rated speed is 50 fpm (0.25 m/s) or less; or
2. Where Type C safeties are used.

3011.6.1.2 Counterweights. On rod type counterweights, the rod nuts shall be cotter-pinned and the tie rods shall be protected so the head weight cannot crush the tie rods on buffer engagement.

1. The weights shall be protected so that they cannot be dislodged.
2. Compensating chains or ropes shall be fastened to the counterweight frame directly or to a bracket fastened to the frame and shall not be fastened to the tie rods.

3011.6.2 Car frames and platforms.

3011.6.2.1 Car platforms. Every elevator car shall have a platform consisting of a nonperforated floor a platform frame supported by the car frame and extending over the entire area within the car enclosure.

1. Holes in the floor for the safety plank wrench, etc., shall be covered and secured.
2. The platform frame members and the floor shall be designed to withstand the forces developed under the loading conditions for which the elevator is designed and installed.

3011.6.2.2 Platform guards (aprons). The entrance side of the platform of passenger and freight elevators equipped with leveling devices or truck-zoning devices shall be provided with smooth metal guard plates of not less than 0.0598 inch (1.519 mm) thick steel, or material of equivalent strength and stiffness, adequately reinforced and braced to the car platform and conforming with the following:

1. The guard plate shall extend not less than the full width of the widest hoistway door opening.
2. It shall have a straight vertical face, extending below the floor surface of the platform, of not less than the depth of the leveling of truck zone, plus 3 inches (76 mm).
3. If new guards are installed, the lower portion of the guard shall be bent back at an angle of not less than 60° nor more than 75° from the horizontal.
4. The guard plate shall be securely braced and fastened in place to withstand a constant force of not less than 150 lbf (667 N) applied at right angles to and at any position on its face without permanent deformation.

3011.6.2.3 Hinged platform sills. Hinged platform sills, where provided, shall be provided with electric contacts which will prevent operation of the elevator by the normal operating device unless the hinged sill is within 2 inches (51 mm) of its fully retracted position. The elevator will be operated by the leveling device in the leveling zone with the sill in any position.

3011.6.2.4 Floating (movable) platforms. Floating (movable) platforms which permit operation of the elevator when the car door or gate is not in the closed position are prohibited.

3011.6.3 Car enclosures.

3011.6.3.1 Car enclosures. Car enclosures for freight and passenger cars shall conform with the following:

1. Freight elevator cars:
   1.1. Cars shall be enclosed to a height of at least 6 feet from the floor on all sides, where there are no hoistway doors or gates, with solid panel or openwork which will reject a 2-inch diameter ball.
   1.2. On the side of the car adjacent to the counterweight runway and extending 6 inches each side of the counterweight runway, the enclosure shall extend to the car top or underside of car crosshead.
   1.3. If overhead protection is of openwork material, it shall reject a 1-1/2 inch ball and shall be sufficiently strong to support 300 pounds applied at any point. Simultaneous application of these loads is not required.
   1.4. Suitable overhead protection may be installed directly over the area where the operator runs the controls, providing the overhead protections covers sufficient area for save protection of operator.
2. Passenger elevator cars:
   2.1. Passenger elevator cars shall be fully enclosed on all sides and the top, except the opening for entrances.
   2.2. Enclosures shall be of metal or wood in conformity with local fire regulations.
   2.3. The car top shall be sufficiently strong to support a load of 300 pounds applied at any point. Simultaneous application of these loads is not required.

3011.6.3.2 Material for passenger car enclosure. All materials exposed to the car interior and the hoistway shall be metal or shall conform to the following:

1. Materials in their end use configuration, other than those covered by paragraph (2) below, shall conform to the following requirements, based on the tests conducted in accordance with the requirements of ASTM E 84, ANSI/UL 723 or NFPA 252:
   1.1. flame spread rating of 0 to 75;
   1.2. smoke development of 0 to 450.
2. Napped, tufted, wove, looped, and similar materials in their end use configuration on car enclosure walls shall have a flame spread rating of 0 to 25.
3. Padded protective linings, for temporary use in passenger cars during the handling of freight, shall be of materials conforming to either paragraph 1. or (2) above. The protective lining shall clear the floor by not less than 4 inches (102 mm).
4. Floor covering, underlayment, and its adhesive shall have a critical radiant flux of not less than 0.45 W/ cm2 as measured by ASTM E 648. Floor finish materials of a traditional type such as wood, vinyl, linoleum and terrazzo are permitted to be used.
5. Carpeting without padding may be used for interior finishes provided that it has a Class I rating, a flame spread of 25 or less which shall include all assembly components except the adhesive.

   Exception: Handrails, operating devices, ventilating devices, signal fixtures, audio and visual communication devices, and their housings are not required to comply with this Section 3011.6.

3011.6.3.3 Interior alteration. Alterations or modifications of elevator car interiors shall comply with ASME A17.1/CSA B44 8.7.2.15.2 increase or decrease in deadweight of car). *Seattle Building Code* requirements concerning flame spread rating for wall coverings (See Chapter 8) and lighting requirements of ASME A17.1/CSA B44.

3011.6.3.4 Car doors and gates. Car doors or gates shall be required at each entrance to the elevator car.

1. Car doors or gates may be horizontal or vertical sliding.
2. Gates, except collapsible, may be solid or may be openwork of a design to reject a ball 2 inches in diameter ball. Gates shall be:
    2.1. Constructed of metal or wood; and
    2.2. Designed shall be so designed that they will withstand a lateral pressure of 100# applied at approximately their center without breaking or being permanently deformed and without displacing the gate from its guides or tracks.
3. Collapsible gates shall reject a 3-inch diameter ball when fully extended (closed position) when installed on passenger cars and reject a 4-1/2 ball when fully extended (closed position) when installed on freight cars. Such gates shall not be power-opened for more than one-third of their clear opening distance or for a maximum power opening distance not to exceed 10 inches. Collapsible gates shall have at least every fourth vertical member guided at the top and every second vertical member guided at the bottom.
4. Handles of manually operated collapsible gates nearest the car operating device on elevators operated from the car only shall be so located that the nearest handle is not more than 48 inches (1.22 m) above the car floor. Gate handles shall be provided with finger guards.
5. Car doors and gates when in the fully closed position shall conform to the following specifications:
    5.1. For passenger cars they shall protect the full width and height of the car entrance opening provided that vertically sliding gates may extend from a point not more than 1 inch above the car floor to a point not less than 6 feet above the floor.
    5.2. For freight elevators they shall protect the full width of the car entrance opening. Car doors shall extend from the car floor to a height of not less than 6 feet above the car floor. Vertically sliding gates shall extend from a point not more than 1 inch above the car floor to a point not less than 6 feet above the car floor.
6. Car doors and gates of electric and electro-hydraulic elevators shall be equipped with approved car door or gate electric contacts which will prevent operation of the elevator by the normal operating device unless the car door or gate is in the closed position.

3011.6.3.5 Location of car doors and gates. All elevators, except freight elevators equipped with horizontally swinging doors which are not accessible to the general public and located in factories, warehouses, garages, and similar buildings, shall conform to the following:

1. Location. Doors or gates for automatic or continuous-pressure operation elevators shall be so located that the distance from the face of the car door or gate to the face of the hoistway door shall be not more than the following:
    1.1. Where a swinging-type hoistway door and a car gate are used, 4 inches (102 mm);
    1.2. Where a swinging-type hoistway door and a card door are used 5-1/2 inches (140 mm);
    1.3. Where a sliding-type hoistway door and a car gate or door are used, 5-1/2 inches (140 mm).
2. Measurement of distances. The distances specified shall be measured as follows:
    2.1. Where a multisection car door and multisection hoistway door are used or where one of these doors is multisection and the other is single section, between the sections of the car door and the hoistway doors nearest to each other;
    2.2. Where a multisection car door and a swinging-type hoistway door are used, between the hoistway door and the section of the car door farthest from it. Where space conditions require the use of three speed car doors, the distance shall be measured from the intermediate speed panel;
    2.3. Where a car gate is used, between the car gate and the section of the hoistway door nearest to the car gate.
3. Where existing distances are greater than specified by paragraphs 1 and 2 of this section, a space guard of sheet metal shall be provided, attached to the hoistway door and/or car door.
    3.1. The guard is to be mounted to the door by a tamper-proof means.
    3.2. The bottom of the guard shall be not less than 1/8 (3.2 mm) nor more than 1/2 inch (13 mm) from the edge of the sill.
    3.3. The face of the guard shall run vertically not less than 40 inches (1.01 m) nor more than the height of the lower edge of the vision panel.
    3.4. The guard shall extend the full width of the door.

3.5. The top of the guard shall be inclined toward the face of the door at angle of not less than 60° nor more than 75° from the horizontal.

3.6. Exposed edges shall be beveled or rolled to eliminate sharp edges.

3.7. The guard shall be sufficiently rigid or reinforced to prevent collapsing or denting.

3.8. Mounting of the guard shall have proper clearances at the bottom and sides to permit easy closing of the door and shall not interfere with the self-closing.

3.9. On multisection horizontally sliding doors only the leading or fast panel shall be fitted with the space guard. For swinging doors, the sides of the guard shall be closed if the depth exceeds 5 inches (127 mm).

4. On horizontally sliding hoistway doors where existing clearances are greater than specified by subsections 1 and 2 of this section, a vertical sight guard shall be mounted to the leading edge of the hoistway door. The sight guard shall

4.1. Be mounted with a vertical clearance of not more than 1/2 inch (13 mm) to the sill, to a height of not less than 6 feet (1.8 m); and

4.2. Project from the door, a distance to not more than 1/2 inch (13 mm) nor less than 1/8 inch (3.2 mm) from the hoistway edge of the sill.

5. Only the following devices may be used to render inoperative hoistway door interlocks, the electric contacts of hoistway door combination mechanical locks and electric contacts, or car door or gate electrical contacts:

5.1. Leveling devices

5.2. Truck-zoning devices;

5.3. Hoistway access switch.

5.4. Existing devices which do not conform to the above shall be removed.

3011.6.3.6 Control and operating circuit requirements. The failure of any single magnetically operated switch, contactor, or relay to release in the intended manner, or the occurrence of a single accidental ground, shall not permit the car to start or run if any hoistway door interlock is unlocked or if any hoistway door or car door or gate electric contact is not in the closed position.

3011.6.3.7 Emergency exits.

1. Top emergency exits.

1.1. Cars provided with a car top emergency exit. Top emergency exit covers shall be hinged or otherwise attached to the car top so that the cover can be opened from the top of the car only and opens outward.

1.2. The exit cover of the lower compartment of a multideck elevator car shall be openable from either compartment.

2. Side emergency exits.

2.1. Side emergency exit doors or panels, where provided, shall have a lock arranged so that the door may be opened from the inside of the car only by a special shaped removable key and outside the car by means of a nonremovable handle.

2.2. All side emergency car exits shall be equipped with electric contacts to prevent the movement of the car if the exit door or panel is not closed, see 3011.6.10.5(16). Side emergency exit door panels shall open only into the car.

3011.6.3.8 Car illumination.

1. Interiors of cars shall be provided with not less than 2 electric lights.
2. The minimum illumination at the car threshold, with the door closed, shall not be less than:

2.1. For passenger elevators: 5 footcandle (54 lux);

2.2. For freight elevators 2-1/2 footcandle (27 lux).

3. Light control switches are not required, but if provided, they shall be located in or adjacent to the car's onboard operating device.
4. In elevators having automatic operation, the light control switch shall be of the key-operated type or located in a fixture with a locked cover.
5. Light fixtures mounted on car tops shall be equipped with a non-key operated switch located in or adjacent to the fixture.
6. A readily accessible and labeled toggle-type test switch shall be provided on the top of the car to cut lighting power manually to test the emergency lighting.

3011.6.3.9 Car top work light. A permanently wired work light and outlet shall be installed on the top of freight and passenger elevators to provide adequate illumination for inspection and work in the hoistway. The top of car light fixtures shall be provided with a non-keyed switch in or adjacent to the fixture. The fixture shall be protected from accidental breakage.

3011.6.4 Safeties.

3011.6.4.1 Safeties. The car of every elevator suspended by wire ropes shall be provided with car safeties. The safety device shall be capable of stopping and sustaining the entire car with its rated load in the event of cable severance or overspeed. There shall be a switch provided on the car actuated by the setting of the safeties that will remove the electric power from the driving machine motor and brake. Car safeties are identified and classified on the basis of performance characteristics after the safety begins to apply pressure on the guide rails.

1. Type A safeties. Safeties which develop a rapidly increasing pressure on the guide rails during the stopping interval, the stopping distance being very short due to the inherent design of the safety. The operating force is derived entirely from the mass and motion of the car or the counterweight being stopped. These safeties apply pressure on the guide rails through eccentrics, rollers, or similar devices without any flexible medium purposely introduced to limit the retarding force and increase the stopping distance.
2. Type B safeties. Safeties which apply limited pressure on the guide rails during the stopping interval, and which provide stopping distances that are related to the mass being stopped and the speed at which application of the safety is initiated. Retarding forces are reasonably uniform after the safety is fully applied. Continuous tension in the governor rope may or may not be required to operate the safety during the entire stopping interval. Minimum and maximum distances are specified on the basis of governor tripping speed.
3. Type C safeties (Type A with oil buffers). Safeties which develop retarding forces during the compression stroke of one or more oil buffers interposed between the lower members of the car frame and a governor-operated Type A auxiliary safety plank applied on the guide rails. The stopping distance is equal to the effective stroke of the buffers.
4. Type G safeties. Safeties similar to Type B except having a gradually increasing retarding force. This safety may be either of the wedge clamp type or the flexible guide clamp type applied a cable which unwinds a drum below the car floor.
5. Slack rope safeties that are actuated by the slackening or breaking o the hoisting ropes. This type of safety is not actuated by an overspeed governor.

3011.6.4.2 Maximum permissible movement of governor rope to operate the safety mechanism. For all Type B safeties, the movement of the governor ropes relative to the car or the counterweight, respectively, required to operate the safety mechanism from its fully retracted position to a position where the safety jaws begin to exert pressure against the guide rails shall not exceed the following values based on rated speed:

1. For car safeties:
    1.1. 200 fpm (1.02 m/s) or less: 42 inches (1.07 m)
    1.2. 202 fpm (1.03 m/s) to 375 fpm (1.90 m/s): 36 inches (914 mm).
    1.3. Over 375 fpm (1.91 m/s): 30 inches (762 mm).
2. For counterweight safeties: 42 inches (1.07 m) for all speeds.
3. Drum-operated car and counterweight safeties, requiring continual unwinding of the safety drum rope to fully apply the safety, shall be so designed that not less than tree turns of the safety rope will remain on the drum after the overspeed test of the safety has been made with the rated load in the car.

3011.6.4.3 Rail lubricants and lubrication plate. Rail lubricants or coatings which will reduce the holding power of the safety or prevent its functioning as required shall not be used.

1. A metal plate shall be securely attached to the car crosshead in an easily visible location and, where lubricants are to be used, shall carry the notation, “Consult manufacturer of the safety for the characteristics of the lubricant to be used.” If lubricants are not to be used, the plate shall so state.
2. If lubricants other than those recommended by the manufacturer are used, a safety test should be made to demonstrate that the safety will function as required.

3011.6.5 Speed governors.

3011.6.5.1 Governors. A speed governor or inertia trip safety or a slack cable operated safety shall be installed on all elevators and shall be so designed that it will actuate the car safeties before the car attains a speed of 140% of the rated speed. Governor ropes shall be not less than 3/8 inch in diameter, if iron or steel rope, and not less than 3/4 inch if manila rope. Tiller rope shall not be used.

3011.6.5.2 Speed governor overspeed and car safety mechanism switches.

1. A switch shall be provided on the speed governor and operated by the overspeed action of the governor when used with Type B and C car safeties of elevators having a rated speed exceeding 150 fpm (0.76 m/s).
2. A switch shall be provided on the speed governor when used with a counterweight safety for any car speed.
3. For static control, an overspeed switch shall be provided regardless of rated speed and shall operate in both directions of travel.
4. These switches shall, when operated, remove power from the driving-machine motor and brake before or at the same time of application of the safety.
5. Switches used to perform the function specified shall be positively opened and remain open until manually reset. (6) Switches operated by the car safety mechanism shall be of a type which will not reset unless the car safety mechanism has been returned to the "off" position.

3011.6.6 Capacity and loading.

3011.6.6.1 Minimum rated load for passenger elevators. The rated load in pounds (kilograms) for passenger elevators shall be based on the inside net platform areas, and shall be not less than shown in the table below. The inside net platform areas shall be determined as shown in the following table which shows the maximum inside net platform areas for the various common rated loads. If other rated loads are used, they shall be not less than as follows:

1. For an elevator having an inside net platform area of more than 50 feet squared (4.65 m squared),
   W = 0.667AA squared + 66.7A.
2. For an elevator with an inside net platform area of more than 50 feet squared (4.65 m squared),
   W = 0.0467A squared + 125A – 1367.

TABLE 3011.6.6.1
MAXIMUM* INSIDE NET PLATFORM AREAS FOR VARIOUS RATED LOADS

Rated Load, lbs	Inside Net Platform Area, ft.^{2}	Rated Load, lbs	Inside Net Platform Area, ft.^{3}
500	7	5,000	50
600	8.3	6,000	57.7
700	9.6	7,000	65.3
1,000	13.25	8,000	72.9
1,200	15.6	9,000	80.5
1,500	18.9	10,000	88
1,800	22.1	12,000	103
2,000	24.2	15,000	125.1
2,500	29.1	18,000	146.9
3,000	33.7	20,000	161.2
3,500	38	25,000	196.5
4,000	42.2	30,000	231
4,500	46.2		
*To allow for variations in cab designs, an increase in the maximum inside net platform area not exceeding 5% will be permitted for the various rated loads.			

NOTE:
A = inside net platform area, ft. squared
W = minimum rated load, lb.

3011.6.6.2 Use of partitions for reducing inside net platform area. When partitions are installed in elevator cars for the purpose of restricting the platform net area for passenger use, they shall be permanently fastened in place.

1. Gates, doors, or handrails shall not be used as partitions.
2. Partitions shall be installed to permit approximately symmetrical loading.
3. When conditions do not permit symmetrical loading, guide rails, car frames, and platforms shall be capable of sustaining the resulting stresses and deflections.

3011.6.6.3 Minimum rated load for freight elevators. The minimum rated load for freight elevators in pounds (kilograms) shall be based on the weight and class of the load to be handled, but shall in no case be less than the minimum specified in subsection (2) of this section for each class of loading based on the inside net platform area. Freight elevators shall be designed for one of the following classes of loading:

1. Class A – General freight loading: Where the load is distributed, the weight of any single piece of freight or of any single hand truck and its load is not more than one-quarter of the rated load of the elevator, and the load is handled on and off the car platform manually or by means of hand trucks. For this class of loading, the rated load shall be based on not less than 50 lbs./ft. squared of inside net platform area.
2. Class B – Motor vehicle loading: Where the elevator is used solely to carry automobile trucks or passenger automobiles up to the rated load of the elevator. For this class of loading, the rated load shall be based on not less than 30 pounds/foot squared of inside net platform area.
3. Class C – Industrial truck loading: Where the load is carried in transit or is handled on and off the car platform by means of power industrial trucks or by hand trucks having a loaded weight more than one-quarter the rated load of the elevator. For this class of loading the following requirements apply:
    3.1. The rated load shall be based on not less than 50 pound/foot squared (244 kg/m squared) of inside net platform area;
    3.2. The weight of the loaded industrial truck shall not exceed the rated load of the elevator;
    3.3. The weight of the loaded industrial truck plus any other material carried on the elevator shall not exceed the rated load when the industrial truck is also carried;
    3.4. During loading and unloading, the load on the elevator shall in no case exceed 150% of the rated load, and where this load exceeds the rated load, the capacity of the brake and the traction relation shall be adequate to safely sustain and level at least 150% of the rated load.

Note: When the entire rated load is placed on the elevator by the industrial truck in increments, the load imposed on the car platform while the last increment is being loaded or the first increment unloaded will exceed the rated load by the weight of the empty industrial truck.

3011.6.6.4 Capacity plates.

1. Every elevator shall be equipped with a capacity plate or painted sign that is permanently and securely fastened in place and located in a conspicuous position inside the car. It shall indicate the rated load of the elevator in pounds, and for freight elevators, this plate or sign shall indicate:
    1.1. The capacity for lifting one-piece loads;
    1.2. For freight elevators used for industrial truck loading where the truck is not usually carried by the elevator but used only for loading and unloading, the maximum load the elevator is designed to support while being loaded or unloaded.
2. Capacity plates shall be durable and readily legible. The height of the letters and figures shall be at least 1/4 inch for passenger elevators and 1 inch for freight elevators.

3011.6.6.5 Signs on freight elevators. In addition to the capacity plate or painted sign on freight elevators, two other signs shall be installed or painted inside the car in a conspicuous place and permanently and securely fastened to the car enclosure. They shall be durable and easy to read with 1/2-inch letters, as follows:

1. In elevators not permitted to carry passengers, the sign shall read, “This is not a passenger elevator; no persons other than the operator and freight handlers are permitted to ride on this elevator.”
2. In elevators permitted to carry employees, the sign shall read, “No passengers except employees permitted.”

3011.6.7 Driving machines and sheaves.

3011.6.7.1 General requirements.

1. Sheaves and drums shall be made of cast iron or steel and shall have finished grooves for ropes.
2. Set screws fastenings shall not be used in lieu of keys or pins on connections subject to torque or tension.
3. Friction gearing or a clutch mechanism shall not be used to connect a driving-machine drum or sheave to the main driving mechanism, other than in connection with a car leveling device.

3011.6.7.2 Winding drum machines.

1. Winding drum machines shall be equipped with a slack-rope device with an enclosed switch of the manually reset type which shall cause the electric power to be removed from the elevator driving machine motor and brake if the hoisting ropes become slack or broken.
2. Winding drum machines shall be equipped with adjustable machine automatic terminal stop mechanisms set to directly open the main line circuit final terminal stopping switch. Chain, belt, or rope-driven mechanisms shall not be used.

3011.6.7.3 Indirect drive machines.

1. Indirect drive machines, utilizing V-belts, toot drive belts, or chain drives, shall have at least three belts or chains operating together in parallel as a set. Belt and chain drive sets shall be pre-loaded and matched for length.
2. Belt set selection shall be based upon the manufacturer's rated breaking strength and a safety factor of 10. Chain and sprocket set selection shall be based upon the recommendations in the supplementary information section of ASME/ANSI B29.1, using a service factor of 2.0. Offset links in a chain are permitted. Chain drives and belt drives shall be guarded to protect against accidental contact and to prevent foreign objects from interfering with drives.

   Sprockets in a chain drive set and also in a driven set shall be assembled into a common hub, with the teeth cut in line after assembly to assure equal load distribution on all chains. Tooth sheaves for a belt drive shall be constructed in a manner to assure equal load distribution on each belt in the set.

   Load determination for both the belt and chain sets shall be based on the maximum static loading on the elevator car (full load on the car and the car at rest at a position in the hoistway which creates the greatest load, including either the car or counterweight resting on its buffer).
3. Each belt or chain in a set shall be continuously monitored by a broken belt or chain device of the manually reset type which shall function to automatically interrupt power to the machine and apply the brake in the event any belt or chain in the set breaks or becomes excessively slack. The driving machine brake shall be located on the traction sheave or winding drum assembly side of the driving machine so as to the fully effective in the event the entire belt set or chain set should break.
4. If one belt or chain of a set is worn, stretched, or damaged so as to require replacement the entire set shall be replace. Sprockets and toothed sheaves shall also be inspected on such occasion and replaced if noticeably worn.

3011.6.8 Driving machine brakes.

3011.6.8.1 Drive machine friction brakes. The drive machine shall be equipped with a friction brake applied by a spring or springs, and released electrically.

The brake shall be designed to have a capacity sufficient to hold the car at rest with its rated load. For passenger elevators and freight elevators permitted to carry employees, the brake shall be designed to hold the car at rest with an additional load up to 25% in excess of the rated load.

3011.6.8.2 Driving and release of driving machine brakes. Driving machine brakes shall not be electrically released until power has been applied to the driving machine motor. All power feed lines to the brake shall be opened and the brake shall apply automatically when:

1. The operating device of a car switch or continuous pressure operation elevator is in the stop position;
2. A floor stop device functions;
3. Any of the electrical protective devices in 3011.6.10.5 functions;

Under conditions described in subsection 1 and 2 of this section, the application of the brake may occur on or before the completion of the slowdown and leveling operations.

The brake shall not be permanently connected across the armature of field of a direct current elevator driving machine motor.

3011.6.9 Terminal stopping devices.

3011.6.9.1 Normal terminal stopping devices. Enclosed upper and lower normal terminal stopping devices shall be provided and arranged to slow down and stop the car automatically, at or near the top and bottom terminal landings. Such devices shall function independently of the operation of the normal stopping means and of the final terminal stopping device.

1. Normal stopping devices shall be located on the car, in the hoistway, or in the machine room or machinery space and shall be operated by the movement of the car.
2. Broken rope, tape, or chain switches shall be provided in connection with normal terminal stopping devices located in the machine room or machinery spaces of traction elevators. These switches shall be opened by a failure of the rope, tape, or chain and shall cause the electrical power to be removed from the driving machine motor and brake.

3011.6.9.2 Final terminal stopping devices. Enclosed upper and lower final terminal electro-mechanical stopping devices shall be provided and arranged to prevent movement of the car by the normal operating devices in either direction of travel after the car has passed a terminal landing. Final terminal stopping devices shall be located as follows:

1. Winding drum driving machines. Elevators having winding drum machines shall have stopping switches on the machines and also on the hoistway operated by the movement of the car.

2. Traction driving machines. Elevators having traction driving machines shall have stopping switches in the hoistway operated by the movement of the car.

3011.6.10 Operating devices and control equipment.

3011.6.10.1 Types of operating devices. The following types of operating devices shall not be used:

1. Rope (i.e., shipper rope);
2. Rod operating devices, actuated directly by hand; or
3. Rope operating devices actuated by wheels, levers, or cranks.

3011.6.10.2 Car-switch operation elevators. The handles of lever-type operating devices of car-switch operation elevators must be arranged so that they will return to the stop position and latch there automatically when the hand of the operator is removed.

3011.6.10.3 Passenger elevator emergency stop buttons. Where provided, elevator emergency stop buttons shall be connected to activate the elevator alarm when in the stop position. An optional door hold open switch may be provided, but such door hold open function shall automatically cancel upon activation of a Phase I recall.

3011.6.10.4 Top-of-car operating devices.

1. Elevators with automatic or continuous-operation shall have a continuous-pressure button operating switch mounted on the top of the car for the purpose of operating the car solely from the top of the car. The device shall operate the car at a speed not exceeding 150 fpm (0.76 m/s).
2. The means for transferring the control of the elevator to the top-of-car operating devices shall be on the car top and located between the car crosshead and the side of the car nearest the hoistway entrance normally used for access to the car top.
3. A top-of-car operating station shall be installed on all existing elevators which have more than fifteen feet of travel.

3011.6.10.5 Electrical protective devices. Electrical protective devices shall be provided in accordance with the following:

1. Slack-rope switch: Winding drum machines shall be accompanied by a slack-rope device equipped with a slack-rope switch of the enclosed manually reset type which will cause the electric power to be removed from the elevator driving machine motor and brake if the suspension ropes become slack.
2. Motor-generator running switch: Where generator-field control is used, means shall be provided to prevent the application of power to the elevator driving machine motor and brake unless the motor generator set connections are properly switched for the running condition of the elevator. It is not required that the electrical connections between the elevator driving machine motor and the generator be opened in order to removed power from the elevator motor.
3. Compensating rope sheave switch.: Compensating rope sheaves shall be provided with a compensating rope sheave switch or switches mechanically opened by the compensating rope sheave before it reaches its upper or lower limit of travel to cause the electric power to be removed from the elevator driving machine motor and brake.
4. Broken rope, tape or chain switches used in connection with machine room normal terminal stopping switches: Broken rope, tape or chain switches which meet the requirements of 3011.6.5.2 shall be provided in connection with normal terminal stopping devices located in machine rooms of traction elevators. These switches shall open when a rope, tape, or chain fails.
5. Stop switch on top-of-car: A stop switch shall be provided on the top of every elevator car, which shall cause the electric power to be removed from the elevator driving machine motor and brake, and shall:
    5.1. Be of the manually operated and closed type;
    5.2. Have red operating handles or buttons;
    5.3. Be conspicuously and permanently marked **"STOP"** and indicated the stop and run positions;
    5.4. Be positively opened mechanically (opening shall not be solely dependent on springs);
    5.5. Have red operating handles or buttons;
    5.6. Be conspicuously and permanently marked "stop';
    5.7. Indicate the "stop" and "run" positions; and
    5.8. Be positively opened mechanically and not solely dependent on springs.
6. Car-safety mechanism switch: A switch is required where a car safety is provided.

7. Speed governor overspeed switch: A speed governor overspeed switch shall be provided when required by 3011.6.5.2.
8. Final terminal stopping devices: Final terminal stopping devices shall be provided on every elevator.
9. Emergency terminal speed limiting device: Where reduced stroke oil buffers are provided, emergency terminal speed limiting devices are required.
10. Motor generator overspeed protection: Means shall be provided to cause the electric power to be removed automatically from the elevator driving machine motor and brake should a motor generator set, driven by a direct current motor, overspeed excessively.
11. Motor field sensing means: Where direct current is supplied to an armature and shunt field of an elevator driving machine motor, a motor field current sensing means shall be provided, which shall cause the electric power to be removed from the motor armature and brake unless current is lowering in the shunt field of the motor.

    A motor field current sensing means is not required for static control elevators provided with a device to detect an overspeed condition prior to, and independent of, the operation of the governor overspeed switch. This device shall cause power to be removed from the elevator driving machine motor armature and machine brake.
12. Buffer switches for oil buffers used with Type C car safeties: Oil level and compression switches shall be provided for all oil buffers used with Type C safeties.
13. Hoistway door interlocks or hoistway door electric contacts: Hoistway door interlocks or hoistway door electric contacts shall be provided for all elevators.
14. Car door/gate electric contacts: Car door or gate electric contacts shall be provided on all elevators.
15. Normal terminal stopping devices: Normal terminal stopping devices shall be provided on all elevators.
16. Car side emergency exit electric contacts: An electric contact shall be provided on every car side emergency exit door.
17. Electric contacts for hinged car platform sill: Hinged car platform sills, where provided, shall be equipped with electric contacts.
18. Stop switch in the elevator pit: A stop switch shall be installed in all elevator pits and shall be located adjacent to the normal pit access.

3011.6.10.6 Power supply line disconnecting means.

1. A disconnect switch or a circuit breaker shall be installed and connected into the power supply line to each elevator motor or motor generator set and controller. The power supply line shall be equipped with overcurrent protection inside the machine room or machinery space.
2. The disconnect switch or circuit breaker shall be of the manually closed multipole type and be visible from the elevator driving machine or motor generator set. When the disconnecting means is not within sight of the driving machine, the control panel, or the motor generator set, and additionally manually operated switch shall be installed adjacent to the remote equipment and connected in the control circuit to prevent starting.
3. No provision may be made to close the disconnect switch from any other part of the building.
4. Where there is more than one driving machine in a machine room, disconnect switches or circuit breakers shall be numbered to correspond to the number of the driving machine which they control.

3011.6.10.7 Phase reversal and failure protection. Elevators having polyphase alternating current power supply shall be equipped with a means to prevent the starting of the elevator motor if the phase rotation is in the wrong direction or if there is a failure of any phase.

This protection may be considered to be provided in the case of generator field control having alternating current motor-generator driving motors, provided a reversal of phase will not cause the elevator driving machine motor to operate in the wrong direction. Controllers on which switches are operated by polyphase torque motors provide inherent protection against phase reversal or failure.

3011.6.10.8 Grounding and overcurrent protections.

1. Control and operating circuit requirements shall comply with Article 621-61 of the 1990 Seattle Electrical Code.
2. Grounding methods shall comply with Articles 620-81 through 620-85 of the 1990 Seattle Electrical Code.

3011.6.10.9 Absorption of regenerated power. When a power source is used which, in itself, is incapable of absorbing the energy generated by an overhauling load, means for absorbing sufficient energy to prevent the elevator from attaining governor tripping speed or a speed in excess of 125% of rated speed, whichever is lesser, shall be provided on the load side of each elevator power supply line disconnecting means.

3011.6.10.10 Door bypass system. Door bypass systems, where used, shall conform with the requirements of ASME A17.1-1990 Rule 210.1e.

3011.6.10.11 Restricted opening of doors. All existing passenger elevators in Group R-1 hotels and dormitory buildings shall comply with the following.

1. When a car is outside the unlocking zone, the hoistway doors or car doors shall be so arranged that the hoistway doors or car doors cannot be opened more than 4 inches (102 mm) from inside the car.
2. When the car doors are arranged that they cannot be opened when the car is outside the unlocking zone, the car doors shall be openable from outside the car without the use of special tools.
3. The doors shall be unlockable when the car is within 3 inches (76 mm) above or below the landing and are permitted to be configured to be unlockable up to 18 inches (457 mm) above or below the landing.

3011.6.11 Emergency operation and signaling devices.

3011.6.11.1 Car emergency devices in buildings. Where provided, elevators with an audible signaling device, operable from a switch or button marked "ALARM" which shall be located in or adjacent to each car operating panel. The signaling device shall be located inside the building and audible inside the car and outside the hoistway. One signaling device may be used for a group of elevators.

3011.6.12 Suspension systems and their connections.

3011.6.12.1 Suspension means. Cars shall be suspended by steel wire ropes attached to the car frame or passing around sheaves attached to the car frame. Only iron (low carbon steel) or steel wire ropes, having the commercial classification "elevator wire rope," or wire rope specifically constructed for elevator used may be used for the suspension of elevator cars and for the suspension of counterweights. The wire material for ropes shall be manufactured by the open-hearth or electric furnace process or its equivalent.

3011.6.12.2 Rope data tag. At each rope renewal, a new metal tag shall be securely attached to one of the wire rope fastenings. Rope data tags shall be durable and readily legible. The height of letters and figures shall be no less than 1/16 inch. This data tag shall bear the following information:

1. The diameter in inches;
2. The manufacturer's rated breaking strength;
3. The grade of material used;
4. The month and year the ropes were installed;
5. Whether non-preformed or preformed;
6. Construction classification;
7. Name of the person or firm that installed the ropes;
8. Name of the manufacturer of the ropes;
9. Number of ropes; and
10. The date on which the rope was re-socketed or other types of fastening changed.

** **3011.6.12.2.1 Missing data tags.** In the event an existing data tag cannot be located, a replacement tag shall be created specifying the date of verification of known information.

3011.6.12.3 Factor of safety. The factor of safety of the suspension wire ropes shall not be less than shown on the following table. The factor of safety shall be based on the actual rope speed corresponding to the car's rated speed. The factor of safety shall be calculated by the following formula:

$$F = \frac{(S \times N)}{W} \qquad \textbf{(Formula 3011-1)}$$

where:

N = Number of runs of rope under load. (2:1 roping, twice the number of ropes used; 3:1 roping, three times, etc.).

S = Manufacturer's rated breaking strength of one rope.

W = Maximum static load imposed on all car ropes with the car and its rated load at any position in the hoistway.

TABLE 3011.6.12.3
Minimum Factors of Safety for Suspension Wire Ropes

Rope Speed (fpm)	Minimum Factor of Safety		Rope Speed (fpm)	Minimum Factor of Safety	
	Passenger	Freight		Passenger	Freight
50	7.60	6.65	605	10.85	9.65
75	7.75	6.85	700	11.00	9.80
100	7.95	7.00	750	11.15	9.90
125	8.10	7.15	800	11.25	10.00
150	2.25	7.30	850	11.35	10.10
175	8.40	7.45	900	11.45	10.15
200	8.60	7.65	950	11.50	10.20
225	8.75	7.75	1000	11.55	10.30
250	8.90	7.90	1050	11.65	10.35
300	9.20	8.20	1100	11.70	10.40
350	9.50	8.45	1150	11.75	10.45
400	9.75	8.70	1200	11.80	10.50
450	10.00	8.90	1250	11.80	10.50
500	10.25	9.15	1300	11.85	10.55
550	10.45	9.30	1350	11.85	10.55
600	10.70	8.50	1400-2000	11.90	10.55

3011.6.12.4 Minimum number and diameter of suspension ropes. All elevators, except freight elevators that do not carry passengers or freight handlers and have no means of operation in the car, shall conform to the following requirements:

1. The minimum number of hoisting ropes used is three for traction elevators and two for drum-type elevators. Where a car counterweight is used, the number of counterweight ropes used shall not be less than two.
2. The minimum diameter of hoisting and counterweight ropes is 3/8 inch (9.5 mm). Outer wires of the ropes shall be no less than 0.024 inch (0.61 mm) in diameter. The term "diameter" where used in this section refers to the nominal diameter as given by the rope manufacturer.

3011.6.12.5 Suspension rope equalizers. Suspension rope equalizers, where provided, shall be of the individual-compression spring type.

Equalizers of other types may be used with traction elevators provided the equalizers and fastenings are approved by the authority having jurisdiction on the basis of adequate tensile and fatigue tests made by a qualified laboratory. Such tests shall show the ultimate strength of the equalizer and its fastenings in its several parts and assembly, which shall be no less than 10% in excess of the strength of suspension ropes, provided that equalizers of the single-bar type, or springs in tension, shall not be used to attach suspension ropes to cars or counterweights or to dead-end hitch plates.

Exception: The requirements of this section do not apply to rope equalizers that meet rule 2.20.5 in ASME A17.1-2000/CSA B44:00.

3011.6.12.6 Securing of suspension wire ropes to winding drums. Suspension wire ropes of winding drum machines shall have the drum ends of the ropes secured on the inside of the drum by clamps or by tapered babbitted sockets, or by other means approved by the *building official.*

3011.6.12.7 Spare rope turns on winding drums. Suspension wire ropes of winding drum machines shall have not less than one turn of the rope on the drum when the car is resting on the fully compressed buffers.

3011.6.12.8 Suspension rope fastenings. Spliced eyes by return loop may continue in service. Suspension rope fastening shall conform to the requirements of ASME A17.1 Rule 212.9 1996 when the ropes are replaced.

3011.6.12.9. Auxiliary rope fastening devices. Auxiliary rope fastening devices, designed to support cars or counterweights if any regular rope fastenings fail, may be provided subject to approval by the *building official.*

3011.6.12.10 Compensating means. Compensating chains or ropes shall be fastened to the counterweight frame directly or to a bracket fastened to the frame and shall not be fastened to the tie rods.

3011.7 Hydraulic elevators.

3011.7.1 Scope. This section shall be the minimum standard for existing direct plunger and roped hydraulic elevators.

3011.7.1.1 All hoistways, hoistway enclosures, and related construction shall conform to the applicable requirements of Hoistways and Related Construction for Electric and Hydraulic Elevators. See Section 3011.5.

3011.7.1.2. Hydraulic elevators without safety bulkheads.

1. Oil levels shall be monitored and tracked in a log.
2. The log shall contain the date the oil was added, the reason for the loss of oil, and the amount of oil added.
3. If the reason for the loss of oil cannot be determined, the unit shall be immediately taken out of service and the tests specified in 8.6.5.14.1 and 8.6.5.14.2 ASME A17.1-2019/CSA B44:19 shall be performed.

3011.7.2 Mechanical equipment.

3011.7.2.1 Buffers and bumpers. Car buffers or bumpers shall be provided. Solid bumpers may be used in lieu of buffers where the rated speed is 50 fpm (0.25 m/s) or less.

3011.7.2.2 Car frames and platforms. Car frames and platforms shall conform to the requirements of 3011.6.2.

3011.7.2.3 Car enclosures. Car enclosures shall conform to the requirements of 3011.6.3.

3011.7.2.4 Capacity and loading. Capacity and loading shall conform to the requirements of 3011.6.6.

3011.7.3 Driving machines.

3011.7.3.1 Connection to driving machines. The driving member of a direct plunger driving machine shall be attached to the car frame or car platform with fastenings of sufficient strength to support that member.

The connection to the driving machine shall be capable of withstanding, without damage, any forces resulting from a plunger stop.

3011.7.3.2 Plunger stops. Plungers shall be provided with solid metal stops and/or other means to prevent the plunger from traveling beyond the limits of the cylinder. Stops shall be designed and constructed so as to stop the plunger from maximum speed in the up direction under full pressure without damage to the connection to the driving machine, plunger, plunger connection, or any other parts of the hydraulic system. For rated speeds exceeding 100 feet per minute where a solid metal stop is provided, means other than the normal terminal stopping device (i.e., emergency terminal speed limiting device) shall be provided to retard the car to 100 feet per minute with retardation no greater than gravity, before striking the stop.

3011.7.4 Valves, supply piping, and fittings.

3011.7.4.1 Pump relief valve.

1. Each pump or group of pumps shall be equipped with a relief valve conforming to the following specifications, except as covered by subsection (2) of this section:
    1.1. The relief valve shall be located between the pump and the check valve and shall be of such a type and installed in the by-pass connection so that the valve cannot be shut off from the hydraulic system.
    1.2. The relief valve shall be preset to open at a pressure no greater than 150% of working pressure.
    1.3. The size of the relief valve and bypass shall be sufficient to pass the maximum rated capacity of the pump without raising the pressure more than 25% above that at which the valve opens. Two or more relief valves may be used to obtain the required capacity.
    1.4. Relief valves having exposed pressure adjustments, if used, shall have their means of adjustment sealed after being set to the correct pressure.
2. No relief valve is required for centrifugal pumps driven by induction motors, provided the shutoff, or maximum pressure which the pump can develop, is not greater than 135% of the working pressure at the pump.

3011.7.4.2 Check valve. A check valve shall be provided and shall be so installed that it will hold the elevator car with rated load at any point when the pump stops, or the maintained pressure drops below the minimum operating pressure.

3011.7.4.3 Supply piping and fittings. Supply piping and fittings shall be in sound condition and secured in place.

3011.7.4.4 Flexible hydraulic connections. When flexible hydraulic connections are replaced, the requirements of ASME A17.1, Rule 303.1d 1996 shall be met in all respects. Where flexible connections pass through walls, the replacement shall be made with steel piping.

3011.7.5 Pressure tanks.

3011.7.5.1 General requirements.

1. Capacity. All tanks shall be of sufficient capacity to provide for an adequate liquid reserve to prevent the entrance of air or other gas into the system.
2. Minimal liquid level indicator. The permissible minimum liquid level shall be clearly indicated.

3011.7.5.2 Pressure tanks.

1. Vacuum relief valves. Tanks which may be subjected to vacuum sufficient to cause collapse shall be provided with one or more vacuum relief valves with openings of sufficient size to prevent collapse of the tank.

2. Gauge glasses. Tanks shall be provided with one or more gauge attached directly to the tank and equipped to shut off the liquid automatically in case of failure of the glass. The gauge glass or glasses shall be located so as to indicate any level of the liquid between permissible minimum and maximum levels and be equipped with a manual cock at the bottom of the lowest glass.
3. Pressure gauge. Tanks shall be provided with a pressure gauge which will indicate the pressure correctly to no less than 1-1/2 times the pressure setting of the relief valve. The gauge shall be connected to the tank or water column by pipe and fittings with a stop cock in such a manner that it cannot be shut off from the tank except by a stop cock. The stop cock shall have a "T" or level handle set in line with the direction of flow through the valve when open.
4. Inspector's gauge connection. Tanks shall have a 1/4 inch pipe size valve connection for attaching an inspector's pressure gauge when the tank is in service.
5. Liquid level detector. Tanks shall be equipped with a means to render the elevator inoperative if, for any reason, the liquid level in the tank falls below the permissible minimum.
6. Handholes and manholes. Tanks shall be equipped with means for internal inspection.
7. Piping and fittings for gauges. Piping and fittings for gauge glasses, relief valves, and pressure gauges shall be of a material that will not be corroded by the liquid used in the tank.

3011.7.6 Terminal stopping devices.

3011.7.6.1 Terminal stopping devices. Terminal stopping devices shall conform to the requirements of 3011.6.9.

3011.7.7 Operating devices and control equipment.

3011.7.7.1 Operating devices. Operating devices shall conform to the requirements of 3011.6.10.2.

3011.7.7.2 Top-of-car operating devices. Top-of-car operating devices shall be provided and shall conform to the requirements of 3011.6.10.1 and 3011.6.10.2, except for uncounterweighted elevators having a rise of no more than 15 feet.

3011.7.7.3 The bottom normal terminal stopping device may be made ineffective while the elevator is under control of the top-of-car operating system.

3011.7.7.4 Anti-creep leveling devices. Each elevator shall be provided with an anti-creep leveling device conforming to the following specifications:

1. It shall maintain the car within 3 inches of the landing regardless of the position of the hoistway door.
2. For electrohydraulic elevators, it shall operate the car only in the up direction.
3. For maintained pressure hydraulic elevators, it shall operate the car in both directions.
4. Its operation may depend on the availability of the electric power provided that:
    4.1. The power supply line disconnecting means required by 3011.6.10.6 is kept in the closed position at all times except during maintenance, repairs, and inspections.
    4.2. The electrical protective devices required by 3011.7.7.5 shall not cause the power to be removed from this device.

3011.7.7.5 Electrical protective devices. Electrical protective devices, if provided, shall conform with the requirements of 3011.6.10.5 and operate as follows:

1. The following devices shall prevent operation of the elevator by the normal operating device and also the movement of the car in response to the anti-creep leveling devices.
    1.1. Stop switches in the pit;
    1.2. Stop switches on top of the car; and
    1.3. Car side emergency exit door electric contacts, where such doors are provided.
2. The following devices shall prevent the operation of the elevator by the normal operating device but the anti-creep leveling device required by 3011.7.7.4 shall remain operative:
    2.1. Emergency stop switches in the car;
    2.2. Broken rope, tape, or chain switches on normal terminal stopping devices when such devices are located in the machine room, machinery space or overhead space;
    2.3. Hoistway door interlocks or hoistway door electric contacts;
    2.4. Car door or gate electric contacts; and
    2.5. Hinged car platform sill electric contacts.

3011.7.7.6 Power supply line disconnects. Power supply line disconnects shall conform to the requirements of 3011.6.10.6.

3011.7.7.7 Devices for making hoistway door interlocks or electric contacts, or car door or gate electric contacts inoperative. The installation shall conform to the requirements of 3011.6.3.5.

3011.7.7.8 Control and operating circuit requirements. Control and operating circuits shall conform to the requirements of 3011.6.3.6.

3011.7.7.9 Emergency operation and signaling devices. Emergency operation and signaling devices shall conform to the requirements of 3011.6.11.1.

3011.7.7.10 Additional requirements for counterweighted hydraulic elevators. Counterweighted hydraulic elevators shall be roped so that the counterweight shall not strike the overhead when the car is resting on its fully compressed buffer.

Where counterweights are provided, counterweight buffers shall be provided.

3011.7.7.11 Roped horizontal hydraulic elevators. Roped horizontal elevators are permitted to continue in service but once taken out of service shall not be reactivated.

3011.8 Escalators.

3011.8.1 Scope. This part is a minimum standard for all escalators used to transport passengers.

3011.8.2 Construction.

3011.8.2.1 Balustrades. The balustrade shall be totally closed except where the handrail enters the newel base. Gaps between interior panels are permitted provided that they are no wider than 3/16 inch (4.8 mm) and the edges are rounded or beveled.

3011.8.2.2 Clearance between skirt and step. The clearance on each side of the steps between the step tread and the adjacent skirt panel shall not be more than 3/16 inch (4.8 mm).

3011.8.2.3 Guards at ceiling or soffit intersections.

1. Guard required. A solid guard shall be provided in the intersection of the angle of the outside balustrade (deck board) and the ceiling or soffit, except as indicated in subsection (2) of this section. The vertical edge of the guard shall be a minimum of 8 inches. The escalator side of the vertical face of the guard shall be flush with the face of the wellway. The exposed edge of the guard shall be rounded and have a minimum width of 1/4 inch (6.4 mm).
2. Guards are not required under the following conditions:
    2.1. On high decks where the clearance of the outside edge of the deck and the ceiling or soffit is more than 12 inches (305 mm) or where the projected intersection of the outside deck and the ceiling or soffit is more than 24 inches (610 mm) from the centerline of the handrail.
    2.2. On low decks where the centerline of the handrail is more than 14 inches (356 mm) from the ceiling or soffit.

3011.8.2.4 Antislide device. On high deck balustrades, antislide devices shall be provided on decks or combination of decks when the outer edge of the deck is greater than 12 inches (305 mm) from the centerline of the handrail or on adjacent escalators when the distance between the centerline of the handrails is greater than 16 inches (406 mm).

These devices shall consist of raised objects fastened to the decks, not closer than 4 inches (102 mm) to the handrail and spaced not greater than 6 feet (1.83 m) apart. The height shall be no less than 3/4 inch (19 mm). There shall be no sharp corners or edges.

3011.8.2.5 Handrails. Each escalator shall be provided with a handrail moving in the same direction and at substantially the same speed as the steps.

3011.8.2.6 Handrail guards. Hand or finger guards shall be provided at the point where the handrail enters the balustrade.

3011.8.2.7 Slotting of step risers. Escalators with smooth curved surface risers shall have either:

1. Steps having cleated risers provided with vertical cleats which mesh with slots on the adjacent step tread as the steps make the transition from the incline to the horizontal; or
2. Means to cause the opening of the power circuits to the escalator driving machine motor and brake should a step be displaced against the upthrust track at the upper and lower curves in the passenger carrying line of the track system.

3011.8.2.8 Slotting of step treads. The tread surface of each step shall be slotted in a direction parallel to the travel of the steps.

3011.8.2.9 Combplates. There shall be a combplate at the entrance and at the exit of every escalator. The combplate teeth shall be meshed with and set into the slots in the tread surface so that the points of the teeth are always below the upper surface of the treads.

3011.8.3 Brakes.

3011.8.3.1 General requirements. Escalators shall be provided with a brake capable of stopping the up or down traveling escalator with any load up to brake rated load. The brake shall be mechanically or magnetically applied. If the brake is magnetically applied, a ceramic permanent magnet shall be used.

3011.8.3.2 Main drive shaft brake. If the escalator brake is separated from the main drive shaft by a chain used to connect the driving machine to the main drive shaft, a mechanically or magnetically applied brake capable of stopping a down running escalator with brake rated load shall be provided on the main drive shaft. If the brake is magnetically applied, a ceramic permanent magnet shall be used.

3011.8.4 Operating and safety devices.

3011.8.4.1 Starting switches. Starting switches shall be of the key-operated type and shall be located so that the escalator steps are within sight.

3011.8.4.2 Escalator starting switches. "Up" and "Down" positions shall be clearly indicated on all starting switches.

3011.8.4.3 Emergency stop buttons. There shall be a red stop button in an accessible location at the top and bottom landings of each escalator. The operation either one of these buttons shall cause the interruption of power to the escalator. It shall be impossible to start an escalator by means of these buttons. These buttons shall be marked **"Escalator Stop Button."**

3011.8.4.4 Speed governor.

1. A speed governor shall be provided, except as specified in subsection (2) of this section. Its operation shall cause the interruption of power to the driving machine if the speed of the steps exceeds a predetermined value, which shall be no more 40% above the rated speed.
2. The speed governor is not required where an alternating current squirrel induction motor is used and the motor is directly connected to the driving machine. (Note: The governor may be omitted in such case even though a chain is used to connect the sprocket on the driving machine to the sprocket on the main drive shaft.)

3011.8.4.5 Broken step-chain device. A broken step-chain device shall be provided to cause the interruption of power to the driving machine if a step chain breaks, and, where no automatic chain tension is provided, if excessive sag occurs in either step chain.

3011.8.4.6 Application of brake. The brake shall automatically stop the escalator when any of the safety devices function.

3011.8.4.7 Broken drive-chain device. When the driving machine is connected to the main drive shaft by a chain, a device shall be provided which will cause the application of the brake on the main drive shaft and also stop the drive machine if the drive chain parts.

3011.8.4.8 Skirt obstruction device. Means shall be provided to stop the escalator if an object becomes accidentally caught between the step and the skirt as the step approaches the upper or lower combplate. The device shall be located so that the escalator will stop before that object reaches the combplate.

3011.8.4.9 Rolling shutter device. Rolling shutters, if used, shall be equipped with a device which will be activated as the shutters begin to close to cause the opening of the power circuit to the escalator driving machine motor and brake.

3011.8.4.10 Reversal stop device. Means shall be provided to cause the opening of the power circuit to the driving machine motor and brake in case of accidental reversal of travel while the escalator is operating in the ascending direction.

3011.8.4.11 Tandem operation. Tandem operation escalators shall be electrically interlocked where traffic flow is such that bunching will occur if the escalator is carrying passengers away from the intermediate landing stops.

The electrical interlocks shall stop the escalator carrying passengers into the common intermediate landing if the escalator carrying passengers away from the landing stops. These escalators shall also be electronically interlocked to assure that thy run in the same direction.

3011.8.4.12 Caution signs. A sign shall be located at the top and bottom landings of each escalator, readily visible to the boarding passengers. The sign shall be of the standard design recognized by the elevator industry and include the following:

1. Caution;
2. Passenger Only;
3. Hold Handrail;
4. Attend Children; and

5. Avoid sides.

3011.8.5 Lighting of step treads.

3011.8.5.1 Lighting of step treads. Step treads shall be illuminated throughout. The light intensity on the treads shall not be less than 5 foot candles (54 lux).

The illumination shall be uniform intensity and shall not contrast materially with that of the surrounding area.

3011.8.5.2 Comb and step distinction. There shall be a visual contrast between the comb and step, achieved by color, pattern, or texture.

3011.8.5.3 Safety zone. The entry and exit zone shall be kept clear of all obstacles. The width of the zone shall be not less than the width between the centerlines of the handrails plus 8 inches. The length of the zone, measured from the end of the newel, shall be not less than twice the distance between the centerlines of the handrails.

Exception: On the entrance side, the safety zone distance may be reduced, when cart restriction devices are installed, with prior written permission from the *building official.*

3011.8.5.4 Landing access plates. Access plates at the top and bottom landings shall be properly located and securely fastened in place when no more than 70 lbf effort is required to open the access plate.

3011.9 Dumbwaiters, hand-powered dumbwaiters, and hand-powered elevators.

3011.9.1 Scope. This is a minimum standard for existing electric and hand-powered dumbwaiters and hand-powered elevators.

3011.9.2 Electric and electro-hydraulic dumbwaiters.

1. Dumbwaiter cars may be constructed of metal or wood and shall be in compliance with local ordinances as to fire resistance providing it is constructed to carry its rated load without distortion. The dumbwaiter car shall be fully enclosed except for the landing sides. The car floor shall not exceed 9 square feet in area, the total inside height shall not exceed 4 feet, and the maximum capacity shall not exceed 500 pounds.
2. Electrically operated machines shall be equipped with brakes that are electrically released and applied automatically by springs in conformity with the requirements set forth in 3011.6.8.1.
3. Dumbwaiters equipped with winding drum machines having a travel of more than 20 feet and a rated load of more than 100 pounds shall be equipped with a slack rope switch which will automatically remove the power from the motor and brake when the hoisting ropes become slack.

3011.9.3 Hand-power elevators and dumbwaiters.

1. Cars of hand-power elevators and dumbwaiters shall be enclosed on all sides not used for entrance. Elevator cars upon which an operator is permitted to ride shall have no more than one compartment.
2. Hand-powered elevators having a travel of more than 15 feet shall have a car safety capable of stopping and sustaining the car and rated load. The car safety device need not be operated by a speed governor and may be of the instantaneous type operated as a result of the breaking and slackening of the suspension members.
3. Hoistway doors for hand-powered elevators shall be designed so that they will ensure protection at each landing.
4. Doors for hand-powered dumbwaiters shall be designed so that they will ensure protection at all landings.
5. Every hoistway door, gate, or entrance of hand-powered elevators and hand-powered dumbwaiters shall have conspicuously displayed on the landing side in letters no less than 2 inches high, the words, “Danger – Elevator – Keep Closed” or “Danger – Dumbwaiter – Keep Closed.”

3011.9.4 Dumbwaiter machinery access. Access doors to dumbwaiter machinery spaces shall be provided with electric contacts and labeled on the exterior side “DANGER-DUMBWAITER” in one-inch letters.

3011.10 Conveyance identification designation and labeling.

3011.10.1 Conveyance identification designation. In any building with more than one elevator, dumbwaiter, escalators or other conveyances a designating numeric, or alphanumeric identification, at least two inches in height identifying each conveyance, shall be located at the main lobby entrance, inside the car, on the machine, on the governor if provided, and on the disconnect switch, or stop switch, in the elevator pit, and if the conveyance has a walk-in pit, the buffer stands and on escalator upper and lower front plates.

3011.10.2 Conveyance labeling. All equipment (disconnect switches, machines, and controllers) operating on a voltage in excess of 250 volts shall be labeled for the voltage used in letterings 3/4 inches high.

3011.11 Requirements for all conveyances for repairs, maintenance, alterations, testing, and periodic inspection.

3011.11.1 Repairs, maintenance, alterations, testing, and periodic inspections. Repairs, maintenance, alterations, testing, and periodic inspections shall be performed in accordance with ASME A17.1/CSA B44 Sections, 8.6, 8.7, 8.10 and 8.11.

3011.11.1.1 Firefighters' emergency operation quarterly testing. Firefighters' emergency operation quarterly testing requirements and documentation see 3028.5.

SECTION 3012
RETROACTIVE REQUIREMENTS FOR EXISTING MATERIAL LIFTS

3012.1 General. Existing material lifts shall be made to comply with the following requirements. (Note: New material lifts shall comply with Section 3013).

3012.2 Hoistway enclosure gates and doors. The openings at each material lift landing shall have gates or doors that guard the full width of the opening. A hoistway door shall be vertically sliding, bi-parting, counter-balanced, or horizontally swinging or sliding. Gates and doors shall meet the following requirements:

1. A balanced-type, vertically sliding hoistway gate shall extend from not more than 2 inches from the landing threshold to not less than 66 inches above the landing threshold.
2. A gate shall be solid or openwork of a design that will reject a ball 2 inches in diameter. A gate shall be located so that the distance from the hoistway face of the gate to the hoistway edge of the landing sill is not more than 2-1/2 inches. A gate shall be designed and guided so that it will withstand a lateral pressure of one hundred pounds applied at approximately its center without breaking or being permanently deformed and without displacing the gate from its guides or tracks.
3. Hoistway gates or doors shall have a combination mechanical lock and electric contact, which shall prevent operation of the material lift by the normal operating devices unless the door or gate is closed.

3012.3 Controls.

1. The control station shall be remotely mounted so that it is inaccessible from the material lift car.
2. Controls shall be clearly marked or labeled to indicate the function of control.
3. All control stations shall have a stop switch. When opened, the stop switch shall remove the electrical power from the driving machine and brake. The stop switch shall:
   3.1. Be manually operated;
   3.2. Have red operating handles or buttons;
   3.3. Be conspicuously and permanently marked "STOP";
   3.4. Indicate the stop and run positions; and
   3.5. Be arranged to be locked in the open position.

3012.4 Capacity posting and no-riders sign. Each material lift shall have a capacity sign permanently and securely fastened in place in the material lift car and on the landings. The sign shall indicate the rated load of the material lift in pounds. The sign shall be metal with black letters two inches high on yellow background.

A sign stating "NO PERSONS PERMITTED TO RIDE THIS DEVICE" shall be conspicuously and securely posted on the landing side of all hoistway gates and doors and in the enclosure of each material lift car. The sign shall be metal with black letters 2 inches high on red background.

SECTION 3013
REQUIREMENTS FOR NEW WAC MATERIAL LIFTS

3013.1 All new material lifts. All new material lifts and *WAC material lifts*, as defined in Section 3004, shall comply with ASME A17.1/CSA B44, Sections 2.7, 2.8 and 3.7 and with one of the following:

1. WAC 296-96 Part C1, Material Lifts, or
2. ASME A17.1/CSA B44, Material Lifts 7.4, 7.5, or 7.6.

SECTION 3014
EMERGENCY SERVICE FOR ELEVATORS IN EXISTING BUILDINGS – PHASE I RECALL

3014.1 General. All existing elevators requiring Phase I recall when installed or under Chapter 93 of the *Seattle Fire Code* shall comply with this section.

Exceptions:

1. Elevators that comply with the standards for new installations provided in Section 3018;
2. Elevators with less than 25 feet of travel if the *building official* and the *fire code official* give written approval; and
3. Elevators that comply with ASME A17.1, Rule 211.3a 1984 edition or later and Sections 3014.10 and 3014.11.

3014.2 Phase I recall keyed switch. A three-position ("on," "off" and "bypass") key cylinder switch shall be provided at each designated level within easy line of sight of the elevator controlled by the switch. If additional switches are provided in a central control station they shall be two position ("off" and "on") key-operated switches.

3014.3 Keyed cylinder-type switches. Keyed cylinder-type switches shall comply with the following:

1. Keys shall be removable only in the emergency ("on") and normal ("off") positions. Keys shall not be removable in the by-pass position.
2. One key shall be provided for each Phase I switch or key cylinder.
3. All emergency operation cylinders (Phases I and II) shall be keyed alike but such key shall not be a part of a building master key system.

3014.4 Key location.

1. A key box meeting the standards of Section 3011.3 shall be provided at the designated recall floor above the Phase I recall switch. The key box is to be mounted approximately 6 feet above the floor. The *building official* is permitted to approve other locations upon request.
2. When a central control station is provided, an additional set of keys shall be provided and hung in the control station in a location designated by the fire chief. The keys shall be identified by a ring or paddle.

3014.5 Key switch functions.

1. The three positions of the switch shall be marked "bypass," "off" and "on."
2. If the switch is in the "off" position, normal elevator service shall be provided and smoke detectors, if required, shall be functional.
3. If the switch is in the "bypass" position, normal elevator service shall be restored independent of any required smoke detectors.
4. If the switch is in the "on" position, the elevators are in Phase I elevator recall mode.

3014.6 Phase I automatic recall operation. If the Phase I recall switch is in the emergency ("on") position:

1. All cars controlled by this switch that are on automatic service shall return nonstop to the designated level and power-operated doors shall open and remain open.
2. A car traveling away from the designated level shall reverse at or before the next available floor without opening its doors.
3. A car stopped at a landing shall have the in-car emergency stop switch or in-car stop switch rendered inoperative as soon as the doors are closed, and the car starts toward the designated level. A moving car, traveling to or away from the designated level, shall have the in-car emergency stop or in-car stop switch rendered inoperative immediately.
4. A car standing at a floor other than the designated level, with doors open and in-car emergency stop switch or in-car stop switch in the run position, shall conform to the following:
   - 4.1. Elevators having automatic power-operated horizontally sliding doors shall close the doors without delay and proceed to the designated level;
   - 4.2. Elevators having power-operated vertically sliding doors provided with automatic or momentary pressure closing operation in accordance with ASME A17.1 Rule 112.3d 1984 or later edition shall have the closing sequence initiated without delay in accordance with ASME A17.1 Rule 112.3d (1), (2), (3), and (5) 1984 or later edition, and the car shall proceed to the designated level;
   - 4.3. Elevators having power-operated doors provided with continuous pressure closing operation per ASME A17.1 Rule 112.3b 1984 or later edition or elevators having manual doors shall conform to the requirements of Section 3014.7. Sequence operation, if provided, shall remain effective
5. Door reopening devices for power-operated doors that are sensitive to smoke or flame shall be rendered inoperative. Mechanically actuated door reopening devices not sensitive to smoke or flame shall remain operative. Car door open buttons shall remain operative. Door closing shall conform to the requirements of ASME A17.1 Rule 112.5 1984 or later edition. Door hold open switches shall be rendered inoperative.
6. All car and corridor call buttons and all corridor door opening and closing buttons shall be rendered inoperative. All call register lights, and directional lanterns shall be extinguished and remain inoperative. Position indicators, if provided, shall remain in service. All prior registered calls shall be canceled.
7. The activation of a smoke detector installed in accordance with Article 93 of the Seattle Fire Code in any elevator lobby or associated elevator machine room, other than the designated level, shall cause all cars in all groups that serve that lobby to return nonstop to the designated level. The fire code official is permitted to approve the connection of other detection devices to activate recall. The operation shall conform to the requirements of Phase I emergency recall operation. Whenever new elevator controllers are installed, they shall meet all provisions of the then current building and elevator codes. Newly installed controllers shall have the capability of selecting alternate recall floors.

3014.7 Attendant-operated recall operation. Attendant-operated elevators shall be provided with visible and audible signals that alert the operator to return to the lobby when the car has been recalled under Phase I control.

3014.8 Dual recall operation. Elevators arranged for dual operation shall conform to all requirements for automatic operation and attendant operation as applicable.

3014.9 Inspection/maintenance recall operation. During inspection operation the audible and visible signals required in Section 3014.7 will be actuated when the car has been recalled under Phase I control. The car shall remain under the control of the operator and/or car top station until the car is returned to service.

3014.10 Nurses' preemption. Nurses' preemption (hospital service) is permitted to commandeer up to one-half of the cars in a particular bank of elevators. At least one-half of the cars shall respond to Phase I and all cars not preempted shall respond.

3014.11 Operation instruction. Instructions for operation of elevators under Phase I shall be incorporated with or adjacent to the Phase I switch at the designated level. Instructions for operation of elevators under Phase II shall be incorporated with or adjacent to the switch, in or adjacent to the operating panel in each car. In addition, Phase I operating instructions shall be adjacent to the Phase I switch in the fire control center and other *approved* locations.

Instructions shall be in letters not less than 1/8 inch (3.2 mm) in height and shall be permanently installed and protected against removal or defacement.

3014.12 Latching. All cars responding to Phase I Recall, activated by a smoke detector or other *approved* detection device, shall return to the appropriate recall floor as determined by the first detector recall signal received. No device other than the Phase I switch is permitted to override the first recall signal received. A later detection signal shall not change the recall floor. Smoke detector activation shall only be reset manually.

SECTION 3015
EMERGENCY SERVICE FOR ELEVATORS IN EXISTING BUILDINGS – PHASE II HIGH RISE IN-CAR OPERATION

3015.1 General. Existing elevators in buildings having floors used for human occupancy located more than 75 feet above the lowest level of fire department vehicle access, or buildings having floors used for human occupancy 35 feet above grade, which lack fire department vehicle access to at least one side shall have Phase II in-car operation and shall comply with this section.

Exceptions:

1. Elevators that comply with the standards for new installations as provided in Section 3019;
2. Elevators with less than 25 feet of travel when the *building official* and *fire code official* give written approval; and
3. Elevators that comply with ASME A17.1 Rule 211.3c 1984 or later edition.

3015.2 Phase II in-car operation key switch.

1. A two-position ("off" and "on") key cylinder switch shall be provided in each elevator car.
2. The switch shall become effective only when the designated level Phase I switch is in the "on" position or a smoke detector has been activated and the car has returned to the designated level. The "on" position shall place the elevator in Phase II in-car operation.
3. The elevator shall be removed from Phase II operation only by moving the switch to the "off" position with the car at the designated level.
4. The switch shall be operable by the Phase I key and such key shall not be part of a building's master key system.
5. The key shall be removable only in the "off" position.
6. One key shall be provided for each Phase II switch or key cylinder.

3015.3 Key location. See Section 3014.4 for the location of the keys.

3015.4 Designated operator. The operation of elevators on Phase II emergency in-car operation shall be by trained emergency service personnel only.

3015.5 Car operation only. An elevator shall be operable only by a person in the car.

3015.6 Corridor call buttons and directional lanterns. All corridor call buttons, and directional lanterns shall remain inoperative.

3015.7 Car and Hoistway Door Operation. The operation of car and hoistway doors shall comply with the following:

1. The opening of power-operated doors shall be controlled only by constant-pressure open buttons or switches.
2. If the constant-pressure open button or switch is released prior to the doors reaching the fully open position, the doors shall automatically reclose. Once doors are fully open, they shall remain open until signaled to close.
3. The closing of power-operated doors shall be by constant pressure of either the call button or door-close button. If a door-close button is supplied, it shall be operable.

4. If the constant-pressure close button or car call button is released prior to the doors reaching the fully closed position, the doors shall automatically reopen. Once doors are fully closed, they shall remain closed until signaled to open.

   Exception: Momentary pressure control of doors using the sill trip-type operator may be permitted as existing; however, the doors shall not open automatically upon arrival at a floor.

3015.8 Door reopening devices. Smoke-sensitive door reopening devices and door hold-open switches shall be rendered inoperative. Non-smoke-sensitive door reopening devices required to be operative under all other conditions may be rendered inoperative under Phase II in-car operation only if the doors are closed by constant pressure.

3015.9 Car call cancellation. All registered calls shall cancel at the first stop.

3015.10 Direction of travel. Direction of travel and start shall be by the car call buttons. With doors in the closed position, actuation of the car call button shall select the floor and start the car to the selected floor. If no door-close button is available, constant pressure of the car call button shall select the floor, close the door, and start the car to the selected floor.

Exception: On proximity-type car call buttons or any other type subject to false firing (calls being placed by line spikes, intermittent loss of power, etc.), the doors shall be closed by a door-close button. Floors may be selected either before or after closing of the doors. The car will start only on the call button or door close button depending on which is the last device to be actuated.

3015.11 Motor generator time out. The motor generator shall not time out automatically.

3015.12 Car position indicators. The car position indicators, when provided, shall be operative.

3015.13 Phase II priority. Phase II operation shall override any floor calls keyed out for security reasons. Floor selection buttons shall be provided in the car to permit travel to all floors served by the car. Means that prevent the operation of these buttons shall be rendered inoperative.

3015.14 False starts. The elevator shall not start if no calls registered.

3015.15 Terminal runs. The elevator shall not make unprogrammed terminal runs.

3015.16 Loss of power. Elevators on fire emergency Phase II car operation shall remain in their respective locations and in Phase II mode upon loss of power. They shall not move unless the elevator is under the control of the operator and power has been restored.

SECTION 3016
NEW INSTALLATIONS – CONSTRUCTION STANDARDS

3016.1 General. All new elevators, escalators, moving walks, dumbwaiters and other conveyances and their installation shall conform to the requirements of ASME A17.1/CSA B44 as amended by this chapter.

3016.2 Wall covering material for passenger cars. Wall covering material for passenger cars shall comply with the following:

1. ASME A17.1/CSA B44 Section 2.14.
2. *Seattle Building Code* requirements concerning flame spread ratings for wall coverings and use of plastics. (See Chapter 8.)

3016.3 Seismic considerations. New installations shall comply with ASME A17.1/CSA B44 Section 8.4. The provisions for Seismic Design Category D shall apply.

3016.4 Accessibility. All new passenger elevators required to be accessible or to serve as part of an *accessible* means of egress shall comply with Sections 1009, 1109.7, and ICC A117.1.

3016.5 Support rails. Support rails are not required. Where support rails are provided in elevator cars, they shall comply with the following:

1. Be securely attached to the wall;
2. Be located at a height between 32 in. and 38 in. from the top of the handrail to the floor; and
3. Be constructed with smooth surfaces and no sharp corners; and
4. Have a minimum clearance of 1-1/2" from the inside of the rail to the wall.

   Exception: The end(s) of the rail(s) are allowed to return toward the wall with no minimum clearance.

5. On cars with side opening door(s) and a support rail(s) installed on the strike side wall(s), the end of the support rail(s) at the entrance side shall return to the wall.

   Exceptions:

   1. If the support rail is entirely located behind the vertical plane established by the face of the entrance strike, the end of the support rail is not required to return to the wall.
   2. Residential, Special Purpose and LULA conveyances are excluded from this requirement.

3016.6 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired. An emergency two-way communication system shall be provided that:

1. Is a visual and text-based and a video-based 24/7 live interactive system.
2. Is fully accessible by the deaf, hard of hearing and speech impaired, and shall include voice-only options for hearing individuals.
3. Has the ability to communicate with emergency personnel utilizing existing video conferencing technology, chat/text software or other approved technology.
4. Conform with ASME A17.1/CSA B44, 2.27.1.

Exception: Private residence elevators are not required to comply with this section.

3016.7 Inclined stairway chairlifts.

3016.7.1 Inclined commercial stairway chairlifts. Governor overspeed testing shall be verified by manufacturer documentation.

3016.7.2 Private residence inclined stairway chairlifts. Battery operated private residence include stairway chairlifts are not required to be permanently wired or installed on an individual branch circuit as required by NEC 620.51(A) Exception 2. These conveyances shall be permitted to use a cord and plug that will act as the equipment disconnecting means. The circuit which is used for the equipment shall have overcurrent protection that will protect the circuit and the equipment. The circuit shall have sufficient capacity to support the additional load of the stairway chairlift. Units that are operated by line voltage shall comply with NEC 620.51(A) Exception 2.

3016.8 Hoistway pressurization. The requirements of Section 3016.8 apply in addition to ASME A17.1/CSA B44, 2.1.4 and Section 713.14.

Note: See Section 909.21, Elevator hoistway pressurization alternative, for other requirements.

1. When pressurization is installed in elevator hoistways, the pressurization of the hoistway shall be measured with all elevator systems in recall mode, Phase I, and all cars at the designated recall level with the doors in the open position.
2. Activation of the fan serving the hoistway pressurization system may be delayed by up to 30 seconds so that elevator recall can be initiated prior to pressurizing the hoistway.
3. Unless specifically installed to serve that space only, environmental air systems and pressurization systems shall not be located in hoistways, elevator mechanical rooms and elevator machinery spaces.

Exceptions:

1. Pressurization ducts serving a hoistway that are separated from the room or space by construction equal to the rated construction of the room or space and so located that all required clearances are maintained.
2. Pressurization duct openings, dampers and grilles are permitted to be located in hoistway shaft walls if the pressurization air does not impair the operation of the elevator.
3. Hoistways shall not be pressurized through pressurization of elevator control rooms or machine rooms. The machine room floor between the hoistway and overhead control rooms or machine room shall contain as few penetrations as possible. All penetrations for cable drops, etc., shall be held to a minimum size.
4. Elevator doors shall operate properly when hoistway pressurization is in effect.
5. Ventilation louver operating motors shall not infringe on any elevator machinery or controller working clearances.

3016.9 Elevator operation on emergency power. All elevators required to be supplied with emergency power shall comply with the following:

1. Each elevator shall be transferable to the emergency power supply system.
2. Emergency power supply systems capable of handling all elevators on the premises need no sequencing or switching other than the possibility of staggering the restarting of the generators.
3. Emergency power supply systems, whose capacity can only handle one elevator of a duplex or one elevator in each elevator group, shall comply with the following.
   - 3.1. All elevators on automatic operation shall be automatically assigned emergency power in sequence and returned to the Phase I recall or lobby floor, where they shall open their doors and then time out of service.
   - 3.2. The last car down will generally be the selected car of a duplex or an elevator group to remain in service. The service shall continue to be automatic.
   - 3.3. The assignment of emergency power will skip or rotate past cars that are out of service (emergency stop switch pulled, malfunction, car top operation, etc.). If assignment is made to a manual or attendant-operated car and the car is unattended, the system shall rotate past the car as though it is out of service.

4. The lights for the car, control room, machine room and machine space shall be activated on the emergency system.
5. A manual emergency power assignment switch or switches shall be in an elevator status panel located in the fire department central control station. Each elevator shall be capable of being assigned emergency power from this location. The manual switching shall be effective at all times other than when the cars are automatically sequencing to the lobby or when the selected car is traveling. The switch shall not remove power in midflight or with doors closed.
6. Elevators on Phase II car operation shall remain in their respective locations upon loss of power. They shall remain in Phase II mode and shall not move unless the elevator is under the control of the operator and normal power has been restored or emergency power has been assigned to the car by either automatic or manual means.
7. Loss of power and initiation of emergency power immediately after Phase I recall operation has occurred shall not cause any cars to be stranded in the building. Upon the application of emergency power to the equipment, the cars shall follow the normal sequencing to the lobby, open their doors and time out of service. When all cars have been bypassed (out of service) or returned to the lobby, the assigned car shall then become available for firefighter's use on Phase II in-car operation.
8. Each elevator operating on emergency power shall be tested in accordance with applicable ASME A17.1/CSA B44, 2.16.8, 2.26.10 and 2.27.2, and ASME A17.2 2020, Part 6.
9. If the elevator cars are recalled to the alternate floor by Phase I recall and a loss of power occurs, the cars shall be sequenced to the alternate floor upon assignment of emergency power. The cars shall not go to the primary designated recall floor under these conditions. The alternate floor shall be provided with a means of identifying the elevator that is supplied with emergency power.
10. The elevator position indicator system, if provided, shall not become disoriented due to the loss of power or any other reason. However, upon the resumption of power, the car may move to reestablish absolute car position.
11. Communications to the car shall remain in service and shall be tested in accordance with applicable ASME A17.1/CSA B44, 2.27.1.

3016.10 Multiple hoistways. The number of elevators permissible in a hoistway is as follows. See ASME A17.1/CSA B44, 2.1.1.4.

1. No more than four elevators shall be in a single hoistway.
2. No more than three elevators serving all or the same portion of a building are permitted to be in a single hoistway.

   Exception: Four elevators serving all or the same portions of a building are permitted to be in a common hoistway under the following conditions:

   1. The hoistway is pressurized; and
   2. Emergency generator power is available to serve both the elevators and pressurization equipment.

3016.11 Additional doors. Doors other than the hoistway door and the elevator car door are prohibited at the point of access to an elevator car except in accordance with applicable provisions in ASME A17.1/CSA B44, 2.11.6.

3016.12 Knox box 1400 series key retainer box. A key retainer box that meets the requirements of this section shall be provided.

1. The box shall be locked and keyed to the secure city access key for elevator and other conveyance access and operation keys.
2. The box shall be located at the designated recall floor above the Phase I recall switch or in the main lobby above the hall call button if no recall feature exists.
3. The box shall be flush or surface mounted approximately 6 feet above the floor.
4. The box shall be attached to the building so as to be able to withstand a force of 300 psf applied horizontally at any point.
5. The box shall be large enough to accommodate all required keys.
6. The box shall be labeled "For Emergency Use."
7. The lock shall be high security Medeco lock specified by the building official.
8. The *building official* may approve other locations and custom box types upon request.

Key retainer boxes for accessibility lifts are permitted to comply with Section 3011.3.1 or 3011.3.2 as an alternative to complying with this section.

3016.13 Elevator access keys. Keys for access to and for the operation of elevator and other conveyance equipment shall be tagged and retained in the key retainer box. The key retainer box shall contain fire emergency service keys (Phase I and II, one key for each switch) and keys to all of the following that are in the building:

1. Doors to the control room, machine room and machine space;
2. Doors preceding elevator control room, machine room, and machine space,

3. Secondary level door;
4. Pit door;
5. Roof door;
6. Independent, hospital emergency and attendant operation;
7. Hoistway access;
8. Mechanical hoistway access devices (broken arm, lunar, etc.);
9. In-car stop switch;
10. Lighting and fan;
11. Fob or card reader for secured car calls and or hall call buttons;
12. Miscellaneous switch keys;
13. Fire alarm panel room;
14. Sprinkler valve control room;
15. Fire command center;
16. Elevator central control station panel.

3016.14 Escalator and moving walk conveyance number designation. In any building with more than one escalator or moving walk, a designating numeric or alphanumeric number, at least two inches in height shall be located on the upper and lower front plates.

3016.15 Elevator car to accommodate ambulance stretcher. In buildings provided with an elevator, at least one elevator shall provide fire department emergency access to all floors served in:

1. Buildings four or more *stories* above or below *grade plane*, and
2. Any R-1, R-2 or I occupancy building regardless of the number of *stories*.

The elevator car shall be of a size and arrangement to accommodate a 24-inch by 84-inch (610 mm by 2134 mm) ambulance stretcher with not less than 5-inch (127 mm) radius corners, in the horizontal, open position. The elevator shall be identified by the international symbol for emergency medical services (star of life). The symbol shall not be less than 3 inches (76 mm) in height and shall be placed inside on both sides of the hoistway door frame on both the designated level and the alternate level.

Exception: Private residence elevators are not required to comply with this section.

Note: The stretcher-sized elevator car may also serve as an *accessible means of egress* as required by Section 1009.2.1 of the *Seattle Building Code.*

3016.16 Signs. A sign complying with ASME A17.1/CSA B44, 2.27.9 shall be posted in the elevator lobby of every elevator equipped for firefighters' emergency operation. The signs shall be located above each hall call fixture noting that the elevators will be recalled to the building lobby on fire alarm.

Exceptions:

1. Elevators with a destination dispatch system that includes electronic lobby touch pads capable of displaying digital signage complying with ASME A17.1/CSA B44, 2.27.9 and activation by firefighters' emergency operation are not required to post physical signage.
2. If *approved* by the *building official*, signs need not be posted in lobbies at the main egress level if the means of egress are obviously identifiable.

A sign indicating a designating numeric or alphanumeric number of each elevator shall be posted and maintained in the elevator lobby at the designated recall level and at alternate recall floors, if provided.

3016.17 Fire service access elevators and occupant evacuation elevators. See Section 403 and ASME A17.1/CSA B44 for provisions related to fire service access elevators and occupant evacuation elevators.

3016.18 Energy efficiency. Elevator systems shall comply with the *Seattle Energy Code*.

Note: The *Seattle Energy Code* includes the following provisions for energy efficiency of elevators and escalators:

C405.9.1 Elevator cabs. For the luminaires in each elevator cab, not including signals and displays, the sum of the lumens divided by the sum of the watts shall be no less than 35 lumens per watt. Ventilation fans in elevators that do not have their own air conditioning system shall not consume more than 0.33 watts/cfm at the maximum rated speed of the fan. Controls shall be provided that will de-energize ventilation fans and lighting systems when the elevator is stopped, unoccupied and with its doors closed for over 15 minutes. accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

C405.9.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

Exception: A variable voltage drive system that reduces operating voltage in response to light loading conditions is allowed to be provided in lieu of the variable speed function.

C405.9.2.1 Energy recovery. Escalators shall be designed to recover electrical energy when resisting overspeed in the down direction.

3016.19 Elevator landing illumination. Elevators shall comply with ASME A17.1/CSA B44, 2.11.10.2 Illumination at Landing Sills, as amended below.

ASME 2.11.10.2 Illumination at Landing Sills. The building corridors shall be so lighted that the illumination at the landing sills, when an elevator is in service, shall be not less than 100 lx (10 fc). Illumination under emergency power shall comply with Section 1008.

3016.20 Roof access path illumination. Lighting of 100 lx (1 ftc.) shall be provided from rooftop access door to the elevator machine room or control room.

3016.21 Testing of car lighting circuit. The car top lighting test switch in 3011.6.3.8 is not required when the car operating panel (cop) provides a button for testing standby power or when the hoistway shares a wall with the machine room or control room.

SECTION 3017
NEW INSTALLATIONS – GENERAL EMERGENCY OPERATION REQUIREMENTS

3017.1 General. All elevators shall conform to the requirements of this section and the specific requirements of Sections 3018, 3019, and ASME A17.1/CSA B 44, 2.27.2.

3017.2 Central control stations or Fire Command Center. The following criteria shall be met if buildings provide a central control station or fire command center in accordance with Section 911:

1. An additional two-position ("off" and "on") Phase I recall switch for each elevator or elevator group shall be installed when the control station is not within easy line of sight of the lobby Phase I recall switches; the switch(es) shall be rotated clockwise to go from "off" to "on" positions;
2. A car position indicator shall be permanently installed, which shall be of a positive type that will not lose the car position nor need resetting on loss of power. Reading of the indicator shall not require special knowledge;
3. Firefighter's phone jacks shall be provided that allow each elevator car to be connected to the fire control center;

   Exception: Fire department radio systems may be provided in lieu of phone jacks if approved by the fire department.
4. A manual emergency power assignment switch;
5. A Phase I indicator;
6. A Phase II indicator.

3017.3 Nurses' preemption. Nurses' preemption (hospital service) may be allowed to commandeer up to one-half of the cars in a particular bank of elevators. At least one-half of the cars shall respond to Phase I and all cars not preempted shall respond.

3017.4 Phase I and II operation instructions. Operation instructions shall be available in accordance with ASME A17.1/CSA B44, 2.27.7. In addition, Phase I operating instructions shall be adjacent to the Phase I switch in the fire command center and other *approved* locations. The Phase II operation instructions shall identify the location of the elevator machine rooms and control rooms.

3017.5 Fireman's visual signal, ASME A17.1/CSA B44, 2.27.3.2.6. Elevators requiring Phase I or Phase II operation shall comply with ASME A17.1/CSA B44 2.27.3.2.6 as amended below:

When Phase I Emergency Recall Operation is initiated by a fire alarm initiating device for any location listed in 2.27.3.2.6(a) through (e) ((,)) is activated during Phase I Emergency Recall Operation as required by 2.27.3.2.4, or Phase II Emergency In-Car Operation as required by 2.27.3.3, the visual signal [see 2.27.3.1.6(h) and Fig. 2.27.3.1.6(h)] shall illuminate intermittently only in a car(s) with equipment in that location, as follows:

(a) machine room

(b) machinery space containing a ((~~motor controller~~)) driving machine

(c) control room

(d) ((~~control space~~)) hoistway

SECTION 3018
NEW INSTALLATIONS – PHASE I

3018.1 Phase I recall requirements.

3018.1.1 ASME A17.1/CSA B44, 2.27.3 General. ASME A17.1/CSA B44, 2.27.3, Firefighters' Emergency Operation: Automatic Elevators, is superseded by the following.

Phase I emergency recall operation shall be provided for all elevators with fully automatic open and close power-operated doors.

3018.1.2 ASME A17.1/CSA B44, 2.27.3.1 Phase I emergency recall operation. Elevators requiring Phase I recall emergency operation shall comply with ASME A17.1/CSA B44, 2.27.3.1 Phase I Emergency Recall Operation, and the following:

Elevator groups containing four or more cars shall be provided with two, three-position key switches per group. Two-position ("off" and "on") switches shall be provided in the fire command center if this code requires such a center. The switch(es) shall be rotated clockwise to go from "off" to "on" position. Hall call buttons common to an elevator group shall remain in service unless both Phase I recall switches of a four-car or larger group are placed in the recall mode, or a fire alarm recall signal is initiated.

Note: See 3028.5 for Phase I and Phase II quarterly testing requirements.

Note: For occupant evacuation elevators see ASME/CSA B44, 2.27.11.

SECTION 3019
NEW INSTALLATIONS – PHASE II IN-CAR REQUIREMENTS

3019.1 Phase II in-car operation. Elevators requiring Phase II in-car operation shall comply with ASME A17.1/CSA B44, 2.27.8 Switch Keys, as amended below.

ASME CSA B44 2.27.8 Switch Keys. The key switches required by 2.27.2 through 2.27.5, and 2.27.11 for all elevators in a building shall be operable by the FEO-K1 key. The keys shall be Group 3 Security (see 8.1). A separate key shall be provided for each switch. These keys shall be kept in the key retainer box required by Section 3016.12 or 3016.19. ((~~on the premises in a location readily accessible to firefighters and emergency personnel, but not where they are available to the public.~~)) This key shall be of a tubular, 7 pin, style 137 construction and shall have a bitting of 6143521 starting at the tab sequenced clockwise as viewed from the barrel end of the key; cutting depths shall be in accordance with Fig. 2.27.8. The key shall be coded "FEO-K1." The possession of the "FEO-K1" key shall be limited to elevator personnel, emergency personnel, elevator equipment manufacturers, and authorized personnel during checking of Firefighters' Emergency Operation (see 8.1). ((~~and 8.6.11.1).~~

~~Where provided, a lock box, including its lock and other components, shall conform to the requirement of UL 1037 (see Part 9).~~

~~NOTE (2.27.8): Local authorities may specify additional requirements for a uniform keyed and its location to contain the necessary keys.~~))

Note: See 3028.5 for Phase I and Phase II quarterly testing requirements.

SECTION 3020
NEW INSTALLATIONS – CONSTRUCTION OF HOISTWAYS, MACHINE ROOMS AND CONTROL ROOMS

3020.1 Construction of hoistways. All new elevator hoistways shall comply with ASME/CSA B44 A17.1, section 2.1 as amended below.

SECTION 2.1
CONSTRUCTION OF HOISTWAYS AND HOISTWAY ENCLOSURES

2.1.1 Hoistway Enclosures

((~~Hoistway enclosures shall conform to 2.1.1.1, 2.1.1.2, or 2.1.1.3.~~))

Hoistways that penetrate a floor/ceiling assembly shall be protected by a fire-resistance-rated enclosure complying with this section.

Exceptions:

1. In other than Group H occupancies, an enclosure is not required for elevators located within atriums complying with Section 404. The elevator is required to comply with 2.1.1.3.
2. Hoistway enclosures are not required to be fire-resistance rated as provided in items 2.1 and 2.2.
   - 2.1. In parking garages, hoistway enclosures that serve only the parking garage are not required to be rated.
   - 2.2. In other than Groups I-2 and I-3, hoistway enclosures are not required to be rated, if the hoistway:
     - 2.2.1. Does not connect more than two stories.
     - 2.2.2. Does not open to a corridor in Group I and R occupancies.
     - 2.2.3. Does not open to a corridor on nonsprinklered floors in any occupancy.
     - 2.2.4. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.
     - 2.2.5. Is limited to one smoke compartment.

2.1.1.1 Fire-Resistive Construction

2.1.1.1.1 Where rated hoistway enclosures are required the enclosure shall be of fire-resistance rated construction as required for shafts by Section 713.4. ((~~Where fire-resistive construction is required, hoistways shall be enclosed in conformance with the requirements of the building code (see 1.3).~~))

2.1.1.1.2 Partitions between hoistways and machine rooms and control rooms

(((~~(a) machinery spaces outside the hoistway~~

~~(b) machine rooms~~

~~(c) control spaces outside the hoistway~~

~~(d) control rooms that have~~)) shall be fire partitions complying with Section 708 having a fire-resistive rating of at least one hour, or shall be of noncombustible solid ((~~or openwork~~)) construction ((~~that meets the requirements of 2.1.1.2.2(d)(1), (2), and (3)~~)). Partitions ((~~of solid construction~~)) shall be permitted to have openings essential for ropes, drums, sheaves, and other elevator equipment.

((~~Openwork construction shall reject a ball 25 mm (1 in.) in diameter, except where there are openings essential for ropes, drums, sheaves, and other elevator equipment.~~))

2.1.1.1.3 Hoistway enclosure openings shall be protected ((~~with entrances or access doors having a fire protection rating conforming to the requirements of the building code~~)) in accordance with Section 716 as required for fire partitions. Doors shall be self- or automatic-closing by smoke detection in accordance with Section 716.2.6.6 and ASME A17.1/CSA B44 2.11.6.3.

2.1.1.2 Non-Fire-Resistive Construction

2.1.1.2.1 Where fire-resistive construction is not required by 2.1.1, ((~~the building code,~~)) hoistway construction shall conform to 2.1.1.2.2 or 2.1.1.3.

2.1.1.2.2 The hoistway shall be fully enclosed ((~~conforming to (a) through (d); (a), (b), and (c).~~

~~(a) Enclosures and doors shall be unperforated to a height of 2 000 mm (79 in.) above each floor or landing and above the treads of adjacent stairways. The enclosure shall be unperforated, adjacent to, and for 150 mm (6 in.) on either side of any moving equipment that is within 100 mm (4 in.) of the enclosure.~~))

(b) Partitions between hoistways and machine rooms and control rooms

(((~~(1) machinery spaces outside the hoistway~~

~~(2) machine rooms~~

~~(3) control spaces outside the hoistway~~

~~(4) control rooms~~)) shall be of solid ((~~or open work~~)) construction ((~~that meets the requirements of (d) (1 through (d), and (3)~~)). Partitions of solid construction shall be permitted to have openings essential for ropes, drums, sheaves, and other elevator equipment. ((~~Openwork construction shall reject a ball 25 mm (1 in.) in diameter, except where there are openings for ropes, drums, sheaves, and other elevator equipment.~~

~~(c) Openwork enclosures, where used above the 2 000 mm (79 in.) level, shall reject a ball 25 mm (1 in.) in diameter.~~

~~(d) Openwork enclosures shall be~~

~~(1) at least 2.2 mm (0.087 in.) thick wire, if of steel wire grille~~

~~(2) at least 2.2 mm (0.0 in.) thick, if of expanded metal~~

~~(3) supported and braced as to deflect not over 15 mm (0.6 in.) when subjected to a force of 450 N (100 lbf) applied horizontally at any point~~))

(e) Enclosures shall be permitted to be glass, provided it is laminated glass conforming to ANSI Z97.1, 16 CFR Part 1201 ((~~CAN/CGSB-12.1, whichever is applicable~~)) (see Part 9). Markings as specified in the applicable standard shall be on each separate piece of glass and shall remain visible after installation.

2.1.1.2.3 Entrances shall be in conformance with 2.11, except 2.11.14 through 2.11.16, and 2.11.18.

2.1.1.3 Partially Enclosed Hoistways. For elevators that are not required to be fully enclosed by 2.1.1, protection at least 2 400 mm (94.5 in.) high shall be provided on the hoistway sides that are located 1 500 mm (59 in.) or less from elevator equipment to areas accessible to other than elevator personnel. Such protection shall comply with 2.1.1.2.

2.1.1.4 Multiple Hoistways. The number of elevators permissible in a hoistway shall be in conformance with the *Seattle Building Code.*

2.1.1.5 Strength of Enclosure. The hoistway enclosure adjacent to a landing opening shall be of sufficient strength to maintain, in true lateral alignment, the hoistway entrances. Operating mechanisms and locking devices shall be supported by the building wall, if load-bearing, or by other building structure. Adequate consideration shall be given to pressure exerted on hoistway enclosures as a result of windage and elevator operation. In *high-rise buildings* in Risk Category III or IV in accordance with Section 1604.5, for fire service access elevators according to Section 403.6.1, and in all buildings that are more than 420 feet (128 m) in *building height*, hoistway enclosures shall comply with Section 403.2.3.

3020.2 Private residence elevator hoistways. Hoistways for private residence elevators shall comply with Section 3020.1. ASME A17.1/CSA B44, 5.3.1.1, 5.3.1.1.1 and 5.3.1.1.2 do not apply.

3020.3 Location of equipment. Motor controllers, motion controllers and drives shall not be located in hoistways.

3020.4 Construction requirements—machine rooms, control rooms and private resident machine and control rooms.

3020.4.1 Elevator machine rooms and control rooms.

3020.4.1.1 Maintain access. Provide and maintain a clear, permanent and safe access to elevator machine rooms and control rooms. Panels or doors for the purpose of accessing nonelevator equipment are not permitted in elevator machine rooms. Passage through the machine room may not be used to gain access to other parts of the building that do not contain elevator equipment.

3020.4.1.2 Location of elevator controls and machinery. Elevator controls and machinery, other than driving machines and governors shall be located in a room dedicated exclusively to elevator equipment. Listed electrical equipment that serves the machine room is permitted to be installed in machine rooms. Air conditioning equipment is permitted to be installed in machine rooms in accordance with ASME A17.1/CSA B44, 2.8.5.

3020.4.2 Fire-resistance rating of machine and control rooms. Elevator machine rooms and control rooms that are adjacent to the hoistway with unprotected openings into the hoistway shall be enclosed by fire partitions and horizontal assemblies with a fire-resistance rating of at least one-hour but not less than the rating of the hoistway. The separation between the room and the hoistway is permitted to be nonrated. Exterior walls and roofs are not required to have a fire-resistance rating unless required by other sections of this code.

ASME A17.1/CSA B44 sections 2.7.1.1 and 2.7.1.2 are superseded by this section.

3020.4.3 Machine rooms and control rooms for electric elevators. All machine rooms and control rooms for electric elevators shall comply with ASME A17.1/CSA B44 Section 2.7, Enclosure of Machine Rooms and Machinery Spaces, except 2.7.1.1 and 2.7.1.2.

3020.4.4 Machine rooms and control rooms for hydraulic elevators. All machine rooms and control rooms for hydraulic elevators shall have fire-resistive construction as required by Section 3020.4. Hydraulic elevator machine and control rooms are permitted to be located overhead, adjacent to, underneath the hoistway, or at a remote location. They shall not be located in the hoistway. Where hydraulic machines and electrical control equipment are located in spaces separated from the hoistway enclosure (see ASME/CSA B44 2.1.1 and 3020.1), such spaces shall be separated from other parts of the building by enclosures conforming to ASME/CSA B44 2.7.1.2 as amended by this code. ASME A17.1/CSA B44 Section 3.7 is superseded by this section.

3020.5 Working clearances. The following working clearances shall be provided inside the machine room or control room for all elevators.

1. The width of working space in front of controllers shall be the width of the controller or 30 inches, whichever is greater. The depth of the working space in the direction of access for controllers, disconnecting means, and other electrical equipment shall be in accordance with SEC 110.26(A)(1).
2. Distances shall be measured from the enclosure or opening if the live parts are enclosed.
3. The minimum clear space working clearances for freestanding equipment shall be 18 inches on two sides and between units of controllers, selectors and/or walls or other building obstructions. The 18-inch side clearance is permitted to be combined to permit 36 inches clear on one side only.
4. The minimum space at the rear of controllers with back-wiring, terminals or other elements requiring access shall be 30 inches.
5. The working space shall be free of pipes, vents, storage, ducts or any other obstruction.
6. The lighting control switch shall be located inside the machine room, and where practical, within 24 inches of the lock jamb side of the machine room door.

3020.5.1 Material lifts and private residence elevator working clearances. If the space outside the room serves as a means of egress, not more than one-half the required egress width shall overlap the working clearance. If space outside the control room or machine room is used to provide working clearance, means shall be provided for protection of the working clearance during alteration, repair and maintenance of elevator equipment. The working clearance shall be located in conditioned space. The room where the controls or machines are located shall comply with all other requirements for control rooms or machine rooms.

3020.6 Location of main line disconnects. In addition to *Seattle Electrical Code* section 620.51, the following apply:

1. The main line disconnect switch(es) or circuit breaker shall be located inside the machine room door on the lock jamb side of the machine room door and not more than 24 inches from the jamb to the operating handle; and it shall be at a height of not more than 66 inches above the finish floor.
2. For multicar machine rooms the switches shall be grouped together as close as possible to that location.
3. For machine rooms with double swing doors, the doors shall swing out and the switch(es) shall be on the wall adjacent to the hinge side of the active door panel.
4. The switch(es) shall be designed so that they may be locked out and tagged in the open position.

Exception: Special purpose, residential elevators and residential inclined elevators are exempt from this section.

3020.7 Temperature control in elevator machine rooms, control rooms, and machinery spaces. Elevator machine rooms, control rooms and machinery spaces that contain the driving machine, and control rooms that contain the operation or motion controller for elevator operation shall be provided with an independent dedicated ventilation or air-conditioning system to control the space temperature to protect against the overheating of the electrical equipment. Ventilation systems shall use outdoor make up air pathway that does not rely on transfer air from other building systems. The system shall be capable of maintaining the temperature and humidity within the range established by the manufacturer's specifications. Where no manufacturer specifications are available, the equipment space temperature shall be maintained at no less than 55 degrees Fahrenheit and no more than 90 degrees Fahrenheit.

The cooling load for the equipment shall include the BTU output of the elevator operation equipment as specified by the manufacturer based on one hour of continuous operation. The outdoor design temperature for ventilation shall be from the 0.5% column for summer from the Puget Sound Chapter of ASHRAE publication "*Recommended Outdoor Design Temperatures, Washington State*." The following formula shall be used to calculate flow rate for ventilation:

CFM = BTU output of elevator machine room equipment/[1.08 x (acceptable machine room temp - make up air temp)]

The ventilation or air-conditioning system will be provided with the same source of power (normal, optional standby, legally required standby, or emergency) as the elevator equipment so that the temperature control is available at all times that the elevators have power.

3020.8 Labeling. Elevator machine and control rooms shall be provided with sign that reads "Elevator Equipment Room/Authorized Personnel Only. Storage of Equipment Not Pertaining to the Elevator Is Prohibited." In buildings with more than one machine room or control room, the label shall identify which cars are served by the equipment in the room(s). Where the room sign is separated from normally occupied areas or normal paths of travel by additional door(s), the additional door(s) shall be provided with signage indicating that the elevator machine or control room or equipment room is on the other side of the door(s). All lettering shall not be less than 0.375 inch (9.25 mm) high and shall contrast with the background.

Exception: Private residence elevators are not required to comply with this section.

3020.9 Machine rooms or control rooms for private residence elevators. Private residence elevators shall be provided with a machine room or control room. No fire resistance rating is required for private residence elevator equipment or machine rooms. Where the machine and brake are located at the top of the hoistway, a minimum 8-inch by 10-inch access panel shall be provided. The panel shall be lockable.

Exception: A separate machine room or control room is not required for private residence elevators which conform with ASME/CSA B44 A17.1, CSA B44 5.3.1.6 Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms as amended below:

5.3.1.6.1 Where elevator equipment is located in a room ((~~or space~~)) that contains other machinery and equipment

(a) the elevator equipment shall be guarded in conformance with 2.10.1. Where the guarding can be removed, a sign in conformance with the reequipments of ANSI Z535.2 or CAN/CSA-Z321, whichever is applicable, shall be located on or adjacent to the guarding warning of the potential hazards.

(b) pipes conveying steam, gas, or liquids shall be guarded or located to prevent discharge onto the equipment.

5.3.1.6.2 The motor controller and operation controller shall be located in a cabinet(s). The cabinet(s) shall be

(a) readily accessible for maintenance and inspection at all times.

(b) provided with a cabinet door(s) or panel(s) that is not self-closing and shall be kept closed.

5.3.1.6.3 In machine rooms, machinery spaces, and control rooms, ((~~and control spaces,~~)) all sheaves and sprockets shall be guarded to protect against accidental contact.

5.3.1.6.4 Maintenance Path and Clearance. A permanent and unobstructed path shall be provided to machinery spaces. ((~~and control spaces.~~)) The path shall provide a clear width 450 (18 in.) minimum. Where elevator equipment is located in a room or space containing other machinery and equipment

(a) the elevator equipment shall be located to eliminate any obstructions that prohibit operating or servicing the equipment.

((~~(b) if an obstruction does not prohibit the operation or servicing of the equipment but creates an interference with servicing the equipment, a sign in conformance with the requirements of ANSI Z535.2 or CAN/CSA-Z321, whichever is applicable, shall be prominently posted at the entrance to the work space warning of the obstruction.~~))

5.3.1.6.5 Temperature and Humidity in Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms. Temperature and humidity shall comply with 2.7.9.2.

SECTION 3021
NEW INSTALLATIONS – FLOORS

3021.1 Floors. All new elevator hoistways, machine rooms and control rooms shall comply with ASME A17.1/CSA B44, 2.1.3.3, Construction of Floors, as amended below. ASME A17.1/CSA B44, 2.1.3.4 is not adopted.

ASME 2.1.3.3 Construction of Floors. Floors of hoistways, control rooms and machine rooms shall ((~~be of concrete or metal construction with or~~)) have a coated or painted concrete or metal surface without perforations that will resist absorption of oil, grease and similar materials. Control rooms and machine rooms shall have floors that cover the entire area of the room. ((~~Metal floors shall conform to the following:~~

~~(a) If of bar type grating, the openings between bars shall reject a ball 20 mm (0.8 in.) in diameter.~~

~~(b) If of perforated sheet metal or of fabricated open-work construction, the openings shall reject a ball 2 mm (1 in.) in diameter.~~))

SECTION 3022
EQUIPMENT IN HOISTWAYS, MACHINE ROOMS AND CONTROL ROOMS
(ASME A17.1/CSA B44 Section 2.8)

3022.1 Prohibited wiring, pipes and ducts. In accordance with ASME A17.1/CSA B44 Section 2.8 non-elevator electric wiring, pipes and ducts are prohibited in elevator machine rooms, control rooms and hoistways except as otherwise provided in this section. The use of false ceilings and furring does not remove such items from the elevator spaces and shall not be acceptable except as allowed by ASME A17.1, 2.8.2 as amended below.

3022.2 Amendment to ASME A17.1/CSA B44 2.8.3. All elevator hoistways, machine rooms and control rooms shall comply with ASME A17.1/CSA B44 2.8.1 and 2.8.3, as amended below.

ASME 2.8 Equipment in Hoistways, Machinery Spaces, Machine Rooms, ((~~Control Spaces,~~)) and Control Rooms

2.8.1 Equipment Allowed. Only machinery and equipment used directly in connection with the elevator shall be permitted in elevator hoistways, ((~~machinery spaces,~~)) machine rooms, ((~~control spaces,~~)) and control rooms.

2.8.3 Pipes, Ducts, Tanks, and Sprinklers

2.8.3.1 ((~~Steam and hot water pipes shall be~~)) Pipes conveying gases, vapors or liquids are not permitted to be installed in hoistways, ((~~machinery spaces,~~)) machine rooms, ((~~control spaces,~~)) and control rooms unless necessary for operation or maintenance of the elevator and not used for any other purpose. ((~~for the purpose of heating these areas only, subject to 2.8.3.1.1 through 2.8.3.1.3.~~))

Exception: Subject to the approval of the *building official*, pipes that are not necessary for operation or maintenance of the elevator are permitted in machine rooms and control rooms if they are protected with double containment and the joints within the machine space, machine room or control room are threaded, soldered or welded. Pipes shall not be located less than 7 feet above the floor in machine rooms.

((~~**2.8.3.1.1** Heating pipes shall convey only low pressure steam [100 kPa (15 psi) or less] or hot water [100° C (212° F) or less].~~

~~**2.8.3.1.2** All risers and return pipes shall be located outside the hoistway. When the machinery space, machine room, control space, or control room is located above the roof of the building, heating pipes for the machinery space, machine room, control space, or control room shall be permitted to be located in the hoistway between the top floor and the machinery space, machine room, control space, or control room.~~

~~**2.8.3.1.3** Traps and shutoff valves shall be provided in accessible locations outside the hoist way.~~))

2.8.3.1.4 The means used for air-sampling smoke detection systems shall be permitted to be installed in hoistways, ((~~machinery spaces,~~)) machine rooms, ((~~control spaces,~~)) and control rooms for the purpose of detecting smoke in accordance with 2.27.3.2, Phase I Emergency Recall Operation by Fire Alarm Initiating Devices, and shall not encroach upon required clearances. Sensing elements penetrating the hoistway enclosure shall have a fire resistance rating conforming to the requirement of the building code.

2.8.3.2 Ducts shall be permitted to be installed in the ((~~hoistway, machinery space,~~)) machine room, ((~~control space,~~)) or control room for the purpose of heating, cooling, ventilating, and venting these areas only and shall not encroach upon the required clearances.

Ducts and electrical conduit are permitted to pass through an elevator machine room or control room if they are separated from the room by construction equal to the rated construction of the room and so located that all required clearances are maintained.

Where ambient conditions require heat and/or cooling of the hoistway, all related equipment, ductwork, piping, and electrical conduit, and controls shall be located outside of the hoistway. Heating, cooling, ventilation, or venting ductwork supply and return grilles are permitted to be installed flush with the interior face of the hoistway wall or hoistway roof where the ductwork penetrations are directly from outside. Heating or cooling equipment thermostat and control wiring shall be installed and accessed from outside the hoistway.

2.8.3.3 Sprinkler systems conforming to NFPA 13 ((~~or the NBCC, whichever is applicable~~)) see Part 9 shall be permitted to be installed in the hoistway, ((~~machinery space,~~)) machine room, ((~~control space,~~)) or control room subject to rules promulgated by the *building official*. ((~~2.8.3.3.1 through 2.8.3.3.4~~))

Note: Also see joint DPD Director's Rule 7-2014/SFD Administrative Rule 9.06.14 for sprinkler requirements.

((~~**2.8.3.3.1** All risers shall be located outside these spaces. Branch lines in the hoistway shall supply sprinklers at not more than one floor level. When the machinery space, machine room, control space, or control room is located above the roof of the building, risers and branch lines for these sprinklers shall be permitted to be located in the hoistway between the top floor and the machinery space, machine room, control space, or control room.~~

~~**2.8.3.3.2** In jurisdictions not enforcing the NBCC, where elevator equipment is located or its enclosure is configured such that application of water from sprinklers could cause unsafe elevator operation, means shall be provided to automatically disconnect the main line power supply to the affected elevator and any other power supplies used to move the elevator upon or prior to the application of water.~~

- ~~(a) This means shall be independent of the elevator control and shall not be self-resetting.~~
- ~~(b) Heat detectors and sprinkler flow switches used to initiate main line elevator power shut down shall comply with the requirements of NFPA 72.~~
- ~~(c) The activation of sprinklers outside of such locations shall not disconnect the main line elevator power supply. See also 2.27.3.3.6.~~
- ~~(d) The activation of sprinklers outside of such location shall not disconnect the mainline elevator power supply. See also 2.27.3.3.6.~~
- ~~(e) This means shall only be provided for elevators that are equipped with Phase I Emergency Recall Operation (see 2.27.3).~~

~~**2.8.3.3.3** Smoke detectors shall not be used to activate sprinklers in these spaces or to disconnect the main line power supply.~~))

2.8.3.3.4 ((~~In jurisdictions not enforcing the NBCC, when~~)) Where sprinklers are installed not more than 600 mm (24 in.) above the pit floor, (a) and (b) apply to elevator electrical equipment and wiring in the hoistway located less than 1200 mm (48 in.) above the pit floor, except earthquake protective devices conforming to 8.4.10.1.2(e);

and on the exterior of the car at the point where the car platform sill is level with the sill at the bottom terminal landing.

(a) Elevator electrical equipment shall be weatherproof (Type 4 as specified in NEMA 250).

(b) Elevator wiring, except traveling cables, shall be identified for use in wet locations in accordance with the requirements in the ((~~NFPA 70~~)) *Seattle Electrical Code*.

2.8.3.4 Other pipes or ducts conveying gases, vapors, or liquid and not used in connection with the operation of the elevator shall not be installed in any hoistway, machinery space, machine room, ((~~control space,~~)) or control room. Where a machinery space, machine room, ((~~control space,~~)) control room, or hoistway extends above the roof of a building, pipes shall be permitted from roof drains to the closest point where they can be diverted out of this space. Pipes shall be covered to prevent leakage or condensate from entering the ((~~machinery space,~~)) machine room, ((~~control space,~~)) control room, or hoistway.

2.8.3.5 Where permitted and provided, pipes, drains, and tanks, or similar equipment that contains liquids, shall not be located directly above the elevator equipment and shall not encroach upon the required clearances in the hoistway, ((~~machinery space,~~)) machine room, ((~~control space,~~)) or control room.

SECTION 3023
PITS (ASME A17.1/CSA B44, 2.2.2)

3023.1 Access to Pits. All pits shall comply with ASME A17.1/CSA B44, 2.2.4 as amended below:

ASME 2.2.4 Pit Access. Safe and convenient access shall be provided to all pits and shall conform to 2.2.4.1 through 2.2.4.6.

2.2.4.1 Access shall be by means of the lowest hoistway door or by means of a separate pit access door.

2.2.4.2 There shall be installed in the pit of each elevator, where the pit extends more than 900 mm (35 in.) below the sill of the pit access door (lowest hoistway door or separate pit access door), a fixed vertical ladder of noncombustible material, located within reach of the access door, a fixed vertical ladder of noncombustible material, located within reach of the access door. The ladder is permitted to be retractable or nonretractable. Nonretractable ladders, where provided, shall conform to 2.2.4.2.1 through 2.2.4.2.6. Retractable ladders, where provided, shall conform to 2.2.4.2.1 through 2.2.4.2.3 and 2.2.4.2.5 through 2.2.4.2.8. When in the extended position, retractable ladders shall conform to 2.2.4.2.4.

2.2.4.2.1 The ladder shall extend not less than 1 200 mm (48 in.) above the sill of the access door or handgrips shall be provided to the same height.

2.2.4.2.2 The ladder rungs, cleats, or steps shall be a minimum of 400 mm (16 in.) wide. When obstructions are encountered, the width shall be permitted to be decreased to less than 400 mm (16 in.). The reduced width shall be as wide as the available space permits, but not less than 225 mm (9 in.).

2.2.4.2.3 The ladder rungs, cleats, or steps shall be spaced 300 mm (12 in.) ± 13 mm (± 0.5 in.) on center, shall be provided to not less than the height of access door sill, and shall be designed to minimize slipping (e.g. knurling, dimpling, coating with skid-resistant material).

2.2.4.2.4 A clear distance of not less than 115 mm (4.5 in.) from the centerline of the rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be provided.

2.2.4.2.5 Side rails, if provided, shall have a clear distance of not less than 115 mm (4.5 in.) from their centerline to the nearest permanent object.

2.2.4.2.6 The ladder and its attachments shall be capable of sustaining a load of 135 kg (300 lb.)

2.2.4.2.7 Retractable ladders that are in the line of movement of the car or counterweight when not fully retracted, shall operate a retractable ladder electrical device (see 2.26.2.38) that shall cause the power to be removed from the elevator driving-machine motor and brake unless the ladder is in its fully retracted position.

2.2.4.2.8 Retractable ladders shall be capable of being extended, mechanically secured and unsecured, and retracted from the access door, and

(a) the force(s) required to extend a retractable ladder from the fully retracted position to the extended and mechanically secured position shall not exceed 220 N (50 lbf)

(b) after being extended and mechanically secured, a retractable ladder shall remain secured in the extended position when subjected to a horizontal force not to exceed 2 220 N (500 lbf)

(c) the force(s) required to retract a retractable ladder from its extended position to its fully retracted position, after being unsecured, shall not exceed 220 N (50 lbf)

(d) the ladder shall be mechanically secured when in the retracted position.

2.2.4.3 Pit access by a ladder shall not be permitted when the pit floor is more than 3 000 mm (120 in.) below the sill of the access door, except where there is no building floor below the bottom terminal landing, this height shall be permitted to be greater but not more than 4 200 mm (165 in.).

2.2.4.4 Pits shall be accessible only to elevator personnel.

2.2.4.5 A separate pit access door, when provided, shall be subject to the following requirements:

(a) If the door swings into the pit, it shall be located so that it does not interfere with moving equipment.

(b) If the door swings out, and the lowest structural or mechanical part, equipment, or device installed beneath the car platform, except guide shoes or rollers or safety jaw assemblies, projects below the top of the separate pit access door opening when the car is level with the bottom terminal landing

(1) an electric contact conforming to 2.26.2.26 shall be provided to prevent operation of the elevator when the door is open

(2) the door shall be provided with a vision panel(s) that is glazed with clear wired glass not less than 6 mm (0.25 in.) thick, will reject a ball 150 mm (6 in.) in diameter, and have an area of not more than 0.03 m^2 (47 $in.^2$).

(c) The door shall provide a minimum opening of 750 mm (29.5 in.) in width and 1 825 mm (72 in.) in height.

(d) The door shall be equipped with a barrier conforming to 2.11.1.2(i), where the door sill is located more than 300 mm (12 in.) above the pit floor.

(e) The door shall be self-closing and provided with a spring-type lock arranged to permit the door to be opened from inside of the pit without a key. Such doors shall be kept closed and locked. A key shall be required to unlock the lock from outside the hoistway. The key shall be of Group 1 Security (see 8.1).

(f) Separate pit access doors shall not be located where a person, upon entering the pit, can be struck by any part of the car or counterweight when either is on its fully compressed buffer, or provided with an electrical contact conforming to 2.26.2.26 shall be provided to prevent operation of the elevator when the door is open.

(g) In hoistways with more than one elevator, a sign shall be provided on the pit access door identifying which cars are served by that hoistway. Lettering shall not be less than 1 inch high and shall contrast with the background of the sign. The sign shall identify which car is to be taken out of service if an electric contact is provided.

2.2.4.6 Means to unlock the access door from inside the pit shall be provided. The means shall be located

(a) when no pit ladder is provided, not more than 1 825 mm (72 in.) vertically above the pit floor, or

(b) when a pit ladder is provided, not more than 1 825 mm (72 in.) vertically above a rung, cleat, or step. The minimum distance from the top rung, cleat, or step to the top of the pit ladder or handhold shall not be less than 1 200 mm (48 in.) (see 2.4.2.1 and Nonmandatory Appendix J, Fig. J-1), and

(c) with the door in the closed position, in a plane not more than 1 000 mm (39 in.) horizontally from a rung, cleat, or step of the pit ladder (see Nonmandatory Appendix J, Fig. J-1).

3023.2 Access to underside of cars. Access to the underside of cars shall comply with ASME A17.1/CSA B44, 2.2.8 as amended below:

2.2.8 Access to Underside of Car. Where the distance from the pit floor to the underside of the plank channels or slings exceeds 2 100 mm (83 in.), with the car at the lowest landing, a means shall be permanently installed or permanently stored in the pit to provide access to the equipment on the underside of the car. When access is provided by means of a working platform it shall conform to the requirements of 2.7.5.3.2 through 2.7.5.3.6.

When working platform inspection operation is provided according to 2.7.5.3.6, in hoistways containing a single elevator

(a) a pit access door is required, or

(b) an additional elevator personnel shall be present outside the hoistway when the pit inspection operation is in effect.

3023.3 Pit sump hole requirements. The pit sump hole shall be sized to accommodate the sump pump provided and shall remove a minimum of 3,000 gallons per hour (gal/h). The sump hole shall be provided with a cover. The cover shall be secured and level with the pit floor.

SECTION 3024
SHUTOFF VALVE (ASME A17.1/CSA B44, 3.19.4.1)

3024.1 Hydraulic elevator shutoff valve. All hydraulic elevators shall comply with ASME A17.1/CSA B44, 3.19.4.1, Shutoff Valve, as amended below:

ASME 3.19.4.1 Shutoff Valve. A manually operated shutoff valve shall be provided between the hydraulic machines and the hydraulic jack.

((~~**3.19.4.1.1** When the hydraulic machine is located outside the hoistway, the shutoff valve shall be located adjacent to the hydraulic machine (see Section 8.1).~~

~~**3.19.4.1.2** Where the hydraulic machine is located in the hoistway, the manually operated shutoff valve shall be permitted to be located inside the hoistway, provided that it is accessible from outside the hoistway to elevator personnel only (see 8.1). The shutoff valve shall have a means to indicate the fully opened and fully closed positions at the location of the operation.~~))

3024.2 Shut-off valves for hydraulic elevators. Two shut-off valves may be required.

(1) ASME requires that a shut-off valve be installed in the machine room.

(2) When the pit is lower than the machine, a shut-off valve shall be installed in the pit.

A separate shut-off valve is not required in the pit for hydraulic elevators equipped with a overspeed valve that rotates no more than 180 degrees to stop the flow of hydraulic fluid and has a safety shut-off handle capable of being grasped.

SECTION 3025
GUARD AT CEILING INTERSECTION (ASME A17.1/CSA B44, 6.1.3.3.11)

3025.1 Escalator guards. All escalators shall comply with ASME A17.1/CSA B44, 6.1.3.3.11, Guard at Ceiling Intersection, and the following:

Guards shall be provided at any pinching, snagging or wedging points between the handrail, balustrade and adjacent building components or equipment if such points are within the clearances delineated in 6.1.3.3.11.

SECTION 3026
TEST REPORTS

3026.1 Test reports. For tests required by Section 3028 and ASME 17.1/CSA B44, Part 8, as amended in this code, immediately after tests are completed all test results shall be submitted to the *building official* for approval on forms furnished by the *building official*. The submitted results shall be signed by the person performing the tests and shall identify the testing firm. Copies of the completed forms shall be provided to the owner or to the owner's authorized agent.

SECTION 3027
ACCEPTANCE INSPECTIONS AND TESTS

3027.1 Acceptance inspections and tests. Inspections and tests shall comply with ASME A17.1/CSA B44, 8.10, Acceptance Inspection and Tests, as amended below.

8.10.1 General Requirements for Acceptance Inspections and Tests

8.10.1.1 Persons Authorized to Make Acceptance Inspections and Tests

8.10.1.1.1 The acceptance inspection shall be made by an inspector employed by the ((~~authority having jurisdiction, or by a person authorized by the authority having jurisdiction~~)) *building official*.

8.10.1.1.2 The person installing or altering the equipment shall perform all of the tests required by 8.10.2 through 8.10.5 in the presence of the inspector specified in 8.10.1.1.1.

((~~**8.10.1.1.3** The inspector shall meet the qualification requirements of the ASME QEI-1. Inspectors and inspection supervisors shall be certified by an independent, accredited, certifying organization as specified in 8.10.1.2 (see Section 1.3).~~))

SECTION 3028
PERIODIC INSPECTIONS AND TESTS

3028.1 Persons authorized to make periodic inspections and witness tests. Periodic inspection and tests shall comply with ASME A17.1/CSA B44, 8.11 as amended below.

8.11.1 General Requirements for Periodic Inspections and Witnessing of Tests

((~~**8.11.1.1 Persons Authorized to Make Periodic Inspections and Witness Tests.** The inspector shall meet the qualification requirements of the ASME QEI- 1. Inspectors and inspection supervisors shall be certified an independent, accredited, certifying organization as specified in 8.10.1.2 (see 1.3).~~))

8.11.1.1.1 Periodic Inspections

(a) Periodic inspections shall be made by an inspector employed by the ((~~authority having jurisdiction~~)) *building official* or by a person authorized by the ((~~authority having jurisdiction~~)) *building official*.

(((~~(b) The inspector shall submit a signed written report to the authority having jurisdiction containing the following information:~~

~~(1) date of inspection(s)~~

~~(2) components or systems that have not been inspected~~

~~(3) Code deficiencies noted during the inspection and a statement as to corrective action taken, if any~~))

8.11.1.1.2 Periodic tests

(a) Periodic tests as required in 8.6 shall be performed by elevator personnel that are qualified to perform such tests. These tests shall be witnessed by an inspector (see 8.11.1.1) employed by the ((~~authority having jurisdiction~~)) *building official*, or by persons authorized by the ((~~authority having jurisdiction~~)) *building official*.

(((~~(b) The inspector shall submit a signed written report to the authority having jurisdiction containing the following information:~~

~~(1) date of inspection(s)~~

~~(2) type of test(s) performed~~

~~(3) detailed results of the test(s) including but not limited to, speed, governor trip speed, safety slide distance, relief valve setting, escalator/moving walk brake torque setting, etc.~~

~~(4) Code deficiencies noted during the test~~

~~(5) statement as to any corrective action taken~~))

8.11.1.2 Applicability of Inspection Requirements. Inspections required by 8.11.2 through 8.11.5 are to determine that the existing equipment conforms with the following applicable Code requirements:

(a) the Code at the time of installation

(b) the Code effective as applicable to and for each alteration

(((~~(c) the ASME A17.3 Code, if adopted by the authority having jurisdiction~~

~~NOTES (8.11.1.2):~~

~~(1) The ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks (see Preface, ASME Elevator Publications) is a guide for inspections.~~

~~(2) References to "Items" of the ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks and to the requirements of this Code are indicated in parentheses as a convenient reference to the applicable inspection procedures and requirements. It is important to understand that suggested test and inspection methodologies represent an approach but are neither exclusive nor comprehensive.~~))

8.11.1.3 Periodic Inspection and Test Frequency. ((~~The frequency of periodic inspections and tests shall be established by the authority having jurisdiction.~~)) The equipment listed in Table 3028 shall be inspected and tested at the intervals specified in Table 3028.

NOTE: Recommended intervals for periodic inspections and tests can be found in ((~~Nonmandatory Appendix N~~)) Table 3028.

((**~~8.11.1.4 Installation Placed Out of Service.~~** ~~Periodic inspections and tests shall not be required when an installation is placed "out of service":~~

~~(a) as defined by the authority having jurisdiction; or~~

~~(b) when an installation whose power feed lines have been disconnected from the mainline disconnect switch; and~~

~~(1) an electric elevator, dumbwaiter, or material lift whose suspension ropes have been removed, whose car and counterweight rest at the bottom of the hoistway, and whose hoistway doors have been permanently barricaded or sealed in the closed position on the hoistway side;~~

~~(2) a hydraulic elevator, dumbwaiter, or material lift whose car rests at the bottom of the hoistway; when provided with suspension ropes and counterweight, the suspension ropes have been removed and the counterweight rests at the bottom of the hoistway; whose pressure piping has been disassembled and a section removed from the premises and whose hoistway doors are permanently barricaded or sealed in the closed position on the hoistway side; or~~

~~(3) an escalator or moving walk whose entrances have been permanently barricaded.~~))

8.11.1.5 Making Safety Devices Ineffective. No person shall at any time make any required safety device or electrical protective device ineffective, except where necessary during tests and inspections. Such devices shall be restored to their normal operating condition in conformity with the applicable requirements prior to returning the equipment to service (see 2.26.7).

8.11.1.6 Reserved for future use.

8.11.1.7 Unique or Product-Specific Procedures or Methods. Where unique or product-specific procedures or methods are required to maintain, repair, replace, inspect, or test equipment, such procedures or methods shall be provided by the manufacturer or installer. These procedures and any unique devices required by the procedures for inspection and testing shall be accessible on site to elevator personnel [see 8.6.1.2.2(b)].

8.11.1.8 Maintenance Control Program. The Maintenance Control Program complying with 8.6.1.2.1 shall be available. On-site equipment documentation complying with 8.6.1.2.2 and maintenance records complying with 8.6.1.4 shall be available.

8.11.1.9 Devices Not Coved in Section 8.11. When any device on which the safety of users is dependent is installed that is not specifically covered in Section 8.11, it shall be inspected and tested in accordance with the requirements of the manufacturer's or the altering company's procedures (see 8.6.1.6.1 and 8.7.1.2). Documentation that contains the testing procedures of these devices shall remain with the equipment and be available in the on-site documentation (see 8.6.1.2.2). The removal or disabling of such devices shall be considered an alteration and shall comply with 8.7.1.2.

TABLE 3028
INSPECTION AND TEST INTERVALS
Note: Intervals are specified in months; sections reference ASME A17.1/CSA B44 unless otherwise specified

Section	Equipment Type	Periodic Inspections		Periodic Tests							
				Category One		Category Three		Category Five		Other	
		Requirement	Interval	Requirement	Interval	Requirement	Interval	Requirement	Interval	Requirement	Interval
8.6.11.1	Firefighter's emergency operation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.6.11.1	3
8.11.2	Electric elevators	8.11.2.1	12	8.6.4.19	12	N/A	N/A	8.6.4.20	60		
8.11.3	Hydraulic elevators	8.11.3.1	12	8.6.5.14	12	N/A	N/A	8.6.5.16	60		
8.11.3	Roped water-hydraulic elevators	8.11.3.1	12	8.6.5.14	12	8.6.5.15	36	8.6.5.16	60		
8.11.4; SBC 3028	Escalators & moving walks	8.11.4.1	12	8.6.8.15	12	N/A	N/A	N/A	N/A	SBC 3028	12
8.11.5.3	Hand elevators	8.11.2.1, 8.11.5.3	12	8.6.l4.19	12	N/A	N/A	8.6.4.20, 8.6.5.16	60		
8.11.5.4	Dumbwaiters	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A	N/A	8.6.4.20, 8.6.5.16	60		
8.11.5.5 WAC 296-96-0555-05620	Material lifts and dumbwaiters with automatic transfer devices	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16 WAC 296-96-05290	60		
8.11.5.6	Special purpose personnel elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
8.11.5.7	Inclined elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
8.11.5.9	Screw-column elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
8.11.5.10	Rooftop elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
8.11.5.11	Rack & pinion elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
8.11.5.12	Limited use/ limited application elevators	8.11.2.1, 8.11.3.1	12	8.6.4.19, 8.6.5.14	12	N/A		8.6.4.20, 8.6.5.16	60		
SBC 3028.6	Power disconnect devices (Shunt Trip)					N/A				3028.6	12

TABLE 3028—continued
INSPECTION AND TEST INTERVALS
Note: Intervals are specified in months; sections reference ASME A17.1/CSA B44 unless otherwise specified

Section	Equipment Type	Periodic Inspections		Periodic Tests							
				Category One		Category Three		Category Five		Other	
		Requirement	Interval	Requirement	Interval	Requirement	Interval	Requirement	Interval	Requirement	Interval
ASME A18.1 11.2.1.c	Accessibility Lifts (sections 2 through 4)	10.1.1, 10.1.6	12	10.2	12	N/A		10.3	60	11.2.1.c	3
ASME A18.1 11.4.1	Accessibility lifts (sections 5 through 7)	10.1.1, 10.1.6	12	10.2	12	N/A		10.3	60	11.4.1	NR

3028.2 Category Five tests. Elevators shall be subject to five-year inspection test requirements in accordance with Table 3028, Periodic Test Requirements – Category Five, except that safety and governor systems of cars operating on wood guide rails shall be tested by tripping the governor by hand with rated load in the car, and the car at rest.

All Category Five tests shall comply with ASME A17.1, 8.6 as amended below:

ASME 8.6.4.20 Periodic Test Requirements – Category 5.

NOTE: For test frequency, see ((~~8.11.1.3~~)) Table 3028.

8.6.4.20.1 Car and Counterweight Safeties. Type A, Type B, and Type C car and counterweight safeties shall be tested in accordance with 8.6.4.20.1(a). ((~~or subject to approval by the authority having jurisdiction with 8.6.4.20.1(b).~~))

(a) *Rated Load and Rated Speed Test.* Car safeties, except those operating on wood guide rails, and their governors, shall be tested with rated load in the car. Counterweight safety tests shall be made with no load in the car. The car speed at which the governor trips shall be determined by means of a handheld tachometer or other device designed to measure car speed, such as controllers, service tools, and accelerometers. Tests shall be made by tripping the governor by hand at the rated speed. If the governor is equipped with a switch that operates when the governor is manually tripped, it must be rendered inoperative. The car safety mechanism switch shall not be rendered inoperative. The emergency brake required by 2.19.3 shall be disabled to prevent it from operating during this test. Since the counterweight safety does not have a safety mechanism switch, the circuit that would remove power from the driving-machine motor and brake must be opened as soon as the elevator stops to minimize slack rope and fallback of the car. The following operational conditions shall be checked (Item 2.29.2):

(1) Type B safeties shall stop the car with the rated load within the required range of stopping distances for which the governor is tripped (Item 2.29.2) and the level of the platform checked for conformance to 2.17.9.2.

(2) For Type A safeties and Type A safety parts of Type C safeties, there shall be sufficient travel of the safety rollers or dogs remaining after the test to bring the car and its rated load to rest on safety application at governor tripping speed. The level of the platform shall be checked for conformance to 2.17.9.2.

(((~~(b) *Alternative Test Method for Car Safeties.* The alternative test methods shall comply with 8.6.11.10 and the following:~~

~~(1) The testing of safeties with any load in the car, centered on each quarter of the platform symmetrically with relation to the centerlines of the platform from no load up to rated load, and at not less than rated speed shall be permitted provided that both~~

~~(a) when the alternative test is performed, the test shall stop the car and verify that the safeties will be capable of stopping an overspeeding car in accordance with the requirements of Section 2.17 applicable to the specific classification of safeties~~

~~(b) when applied, the method shall verify that the safeties perform or are capable of performing in compliance with (a) and the platform shall not be out of level more than 30 mm/m (0.36 in./ft) in any direction.~~

~~(2) The "Periodic Test Record" shall be completed and installed as required by 8.6.1.7.2~~))

8.6.4.20.2 Governors

(a) The tripping speed of the governor and the speed at which the governor overspeed switch, where provided, operates shall be tested to determine conformance with the applicable requirements and the adjustable means shall be sealed (Item 2.13.2.1).

(b) The governor rope pull-through and pull-out forces shall be tested to determine conformance with the applicable requirements, and the adjustment means shall be sealed (Item 2.13.2.1).

(c) After these tests in jurisdictions enforcing NBCC, a metal tag indicating the date of the governor tests, together with the name of the person or firm that performed the tests, shall be attached to the governor in a permanent manner.

8.6.4.20.3 Oil Buffers

(a) Car oil buffers shall be tested to determine conformance with the applicable requirements by either

(1) running the car onto the buffer with rated load at rated speed, or

((~~(2) subject to approval by the authority having jurisdiction~~

~~(a) running the car with any load, from no load up to rated load onto the buffer at rated speed when the requirements of 8.6.11.10 are complied with, provided that when applied the method verifies that the buffer performs or is capable of performing in compliance with 8.6.4.20.3(a), except as specified in 8.6.4.20.3(b) and (c) (Item 5.9.2.1). Counterweight oil buffers shall be tested by running the counterweight onto its buffer at rated speed with no load in the car, except as specified in 8.6.4.20.3(b) and (c) (Item 5.9.2.1), or~~

~~(b) running the car onto the buffer with any load, from no load up to rated load, and at less than rated speed, when the requirements of 8.6.11.10 are complied with, provided that when applied, the method verifies that the buffer performs or is capable of performing in compliance with 8.6.4.20.3(a)~~))

(b) For reduced stroke buffers, this test shall be made at the reduced striking speed permitted (Item 5.9.2.1).

(c) This test is not required where a Type C safety is used (see 8.6.4.20.1).

(d) In making these tests, the normal and emergency terminal stopping devices shall be made temporarily inoperative. The final terminal stopping devices shall remain operative and be temporarily relocated, if necessary, to permit compression of the buffer during the test.

(e) After completion of the test, a metal tag, indicating the date of the test, together with the name of the person or firm who performed the test, shall be attached to the buffer [Item 5.3.2(b)].

(f) Counterweight oil buffers shall be tested by running the counterweight onto its buffer at rated speed with no load in the car, except as specified in 8.6.4.20.3(b) and (c) (Item 5.9.2.1), or at reduced speed if the requirements of 8.6.11.10 are met.

(g) A test tag as required in 8.6.1.7.2 shall be provided.

8.6.4.20.4 Driving-Machine Brake(s). For passenger elevators and all freight elevators, the driving-machine brake shall be tested for compliance with applicable requirements, in accordance with 6(a), ((~~or subject to approval by the authority having jurisdiction with 8.6.4.20.4(b).~~))

For elevators installed under ASME A17.1-2000/CSA B44-00 and later editions, have the brake setting verified in accordance with the data on the brake marking plate.

Upon completion of the test, the means of adjusting the holding capacity shall be sealed to prevent changing the adjustment without breaking the seal. The seal shall bear or otherwise attach the identification of the person or firm that installed it. (See also 8.6.1.7.2, Periodic Test Tags.)

(a) Test with load per Table 8.6.4.20.4. Place the load as shown in Table 8.6.4.20.4 in the car. The driving-machine brake, on its own, shall hold the car with this load. With no load in the car the driving-machine brake shall hold the empty car at rest and shall decelerate an empty car traveling in the up direction from governor tripping speed. The driving-machine brake on freight elevators of Class C-2 loading, when loaded to their maximum design load, shall hold the elevator car at rest (Item 2.17.2.1).

(((~~(b) *Alternative Test Method for Driving-Machine Brakes.* The alternative test methods shall comply with 8.6.11.10 and the following:~~

~~(1) Any method of verifying conformity of the driving-machine brake with the applicable Code requirements (see 2.24.8.3 and Table 8.6.4.20.4) shall be permitted, including the testing method of the brakes with or without any load in the car, provided that when applied the method verifies that the brake performs or is capable of performing in compliance with 8.6.4.20.4(a).~~))

(2) A test tag as required in 8.6.1.7.2 shall be provided.

((~~8.6.11.10 Category 5 Tests Without Load Via Alternative Test Methodologies~~

~~8.6.11.10.1 Where Permitted.~~ ~~Alternative test methods without load are permitted for Category 5 testing subject to approval by the authority having jurisdiction of~~

~~(a) car and counterweight safeties per 8.6.4.20.1~~

~~(b) oil buffers per 8.6.4.20.3~~

~~(c) driving-machine brakes per 8.6.4.20.4, and~~

~~(d) braking system, traction, and traction limits per 8.6.4.20.10~~

~~NOTE: See 8.10, Note (2).~~

~~**8.6.11.10.2 Alternative Test Method and Tools**~~

~~(a) An alternative test method shall be~~

~~(1) based on sound engineering principles~~

~~(2) validated and documented via engineering tests~~

~~(b) The method, measuring devices, and tools shall be capable of producing reliable and consistent measurements, suitable for the intended measurement. The monitoring and calibration of the measuring devices or tools shall be in accordance with the provider's guidelines.~~

~~**8.6.11.10.3 Alternative Test Method Procedure.** The alternative test method shall~~

~~(a) include requirements to obtain and verify car and counterweight masses if necessary for the test~~

~~(b) have a procedure document that~~

~~(1) defines the permissible equipment range and limitations regarding use~~

~~(2) establishes monitoring and calibration criteria for tools or measuring devices as appropriate~~

~~(3) defines the test set-up procedure~~

~~(4) provides instructions on how to interpret results and correlate the results to pass-fail criteria~~

~~(c) describe how to correlate no load test results with previously acquired full load and no load results~~

~~(d) be included in the MCP [see 8.6.1.2.1(a)]~~

~~(e) include the information required by 8.6.1.2.2(b)(5) where applicable~~

~~(f) require a report conforming to 8.6.11.10.4.~~

~~**8.6.11.10.4 Alternative Test Method Report.** The alternative test method report shall~~

~~(a) identify the alternative test tool (make/model) used to perform the test~~

~~(b) identify the company performing the tests, names of personnel conducting and witnessing the tests, and testing dates~~

~~(c) contain all required printouts or record of tests required to demonstrate compliance to the testing requirement that were gathered during an acceptance test~~

~~(d) identify which results from the baseline test are to be used for future compliance evaluation~~

~~(e) record the car and counterweight masses that were obtained per 8.6.11.10.3(a) during the acceptance test and during any subsequent Category 5 test if required by test method~~

~~(f) contain all subsequent Category 5 results with pass-fail conclusions regarding Code compliance~~

~~(g) remain on site or shall be available to elevator personnel and the authority having jurisdiction.~~))

3028.3 Cleaning and testing of escalators and moving walks. In addition to the periodic inspection and tests specified in Table 3028, escalator and moving walk trusses and pans shall be cleaned every 12 months.

3028.4 Step/skirt test. The step/skirt performance index test specified in 8.6.8.15.19 is required for all periodic escalator tests at intervals specified in Table 3028. An escalator and moving walk step/skirt test shall be performed every 12 months by an elevator mechanic licensed in accordance with 70.87.240 RCW.

3028.5 Firefighters' emergency operation quarterly testing. Testing shall comply with ASME A17.1/CSA B44, 8.6.11.1 as amended below.

8.6.11.1 Firefighters' Emergency Operation. All elevators provided with Firefighters' Emergency Operation shall be subjected ((~~monthly~~)) quarterly, by authorized personnel, to Phase I recall by use of the key switch, and a minimum of one-floor operation on Phase II. Deficiencies shall be reported to, and corrected by, elevator personnel. A record of findings shall be available to elevator personnel and the authority having jurisdiction.

((~~NOTE: See Nonmandatory Appendix AA for additional operation verification~~))

3028.6 Annual testing requirements of power disconnect devices also known as shunt trips. Power disconnect devices also known as shunt trips shall be tested annually to ensure they are still properly interfaced with the elevator control. This test applies to electrical and hydraulic elevators.

3028.7 ASME A18.1 11.1 Written Maintenance Program (WMP/MCP). Platform lifts and stairway chairlifts shall be maintained in accordance with ASME A18.1, 11.1 as amended below.

11.1.1 A WMP shall be provided by the manufacturer, installer, or firm performing the maintenance of the equipment for lifts covered by sections 2 through 7. Logs for lifts covered by sections 5 through 7 do not need to include a record of ((~~weekly~~)) quarterly operational checks as required by 11.2.1(f).

11.1.1.1 Maintenance shall be performed by lift personnel.

11.1.1.2 The WMP shall be available to lift personnel.

11.1.2 The WMP for lifts covered by sections 2 through 4 shall include, but not limited to, the following:

(a) routine maintenance and examinations at scheduled intervals to ensure that the installation conforms to the requirements of this Standard.

(b) a log as required by 11.2.

(c) a procedure for checking the operation of the lift to be conducted at least once per ((~~week~~)) quarterly by authorized personnel.

11.1.3 The WMP shall be available at the time of the periodic inspection.

11.1.4 The WMP for lifts covered by sections 5 through 7 does not need to include a procedure for ((~~weekly~~)) quarterly operational checks as required by 11.1.2(c)

SECTION 3029
REQUIREMENTS FOR MAINTENANCE CONTROL PROGRAM AND REMOTE MONITORING

3029.1 ASME A17.1/CSA B44, 8.6.1 General Maintenance Requirements. Conveyances shall be maintained in accordance with ASME A17.1, 8.6.1 as amended below.

8.6.1.2.1 A written Maintenance Control Program [MCP] shall be in place to maintain the equipment in compliance with the requirements of 8.6. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals (see Section 1.3 for the definition of "maintenance") and shall comply with the following:

(a) An MCP for each unit (see 8.6.1.1.1) shall be provided by the person(s) and/or firm maintaining the equipment and shall be viewable on-site by elevator personnel at all times from time of acceptance inspection and test or from the time of equipment installation or alteration (see 8.10.1.5).

(b) The MCP shall include, but not be limited to, the Code required maintenance tasks, maintenance tasks, maintenance procedures, and examination and test listed with the associated requirement (see 8.6.4 through 8.6.11). Where maintenance tasks, maintenance procedures, or examinations or tests have been revised in 8.6, the MCP shall be updated.

(c) The MCP shall reference on-site Equipment documentation (see 8.6.1.2.2) needed to fulfill (b) and on-site maintenance records (see 8.6.1.4.1) that record the completion of all associated maintenance tasks specified in 8.6.1.4.1(a).

(((~~(d) Where the MCP is maintained remotely from the machine room, machinery space, control room, or control space (see 8.11.1.8), instructions for on-site locating or viewing the MCP either in hard copy or in electronic formal shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in.) high.~~)) The MCP shall be posted in the machine room, machinery place or control room.

(e) The specified scheduled maintenance intervals (see 1.3) shall, as applicable, be based on

(1) equipment age, condition, and accumulated wear

(2) design and inherent quality of the equipment

(3) usage

(4) environmental conditions

(5) improved technology

(6) the manufacturer's recommendations and original equipment certification for any SIL rated devices or circuits (see 8.6.3.12 and 8.7.1.9)

(7) the manufacturer's recommendations based on any ASME A17.7/CSA B44.7 approved components or functions

8.6.1.2.2 On-Site Documentation. The documents specified in (a), through (c) shall be written and permanently kept on-site in the machine room, machinery space, control room, ((~~control space, or the means necessary for test (2.7.6.4)~~)) in hard copy for each unit for elevator personnel.

The documentation specified in (d) shall be on-site and available to the specified personnel.

(a) Up-to-date wiring diagrams detailing circuits of all electrical protective devices (see 2.26.2) and critical operating circuits (see 2.26.3)

(b) Procedures for inspections and tests not described in ASME A17.2 and procedures or methods required for elevator personnel to perform maintenance, repairs, replacements, and adjustments, as follows:

(1) all procedures specifically identified in the Code as required to be written (e.g., 8.6.4.20.8, check out procedure for leveling; 8.6.5.16.5, check out procedure for overspeed valve; and 8.6.8.15.7, check out procedure for reversal stop switch)

(2) unique maintenance procedures or methods required for inspection, tests, and replacement of SIL rated E/E/PES electrical protective devices and circuits [See 2.26.4.3.2, 2.26.9.3.2(b), 2.26.9.5.1(b), and 2.26.9.6.1(b).]

(3) unique maintenance procedures or methods required for inspection, tests, and replacement of equipment applied under alternative arrangements (see 1.2.2.1) shall be provided by the manufacturer or installer

(4) unique maintenance procedures or unique methods required for inspection and test of equipment specified in an ASME A17.7/CSA B44.7, code compliance document (CCD)

(5) procedures for tests, periodic inspections, maintenance, replacements, adjustments, and repairs for traction-loss detection means, broken-suspension-member detection means, residual-strength detection means, and related circuits [See 2.20.8.1 through 2.20.8.3, 8.6.4.19.12, 8.6.11.11, 8.10.2.2(cc)(4)(-c)(-s), and 8.10.2.2.2(ss).]

(c) Written checkout procedures

(1) for elastomeric buffers (see 8.6.4.4.2)

(2) to demonstrate E/E/PES function as intended (see 8.6.4.19.10)

(3) for two-way communication means (see 8.6.4.19.15)

(4) for elevator leveling speed with open doors (see 8.6.4.20.8)

(5) for hydraulic elevator overspeed valve (see 8.6.5.16.5)

(6) for escalator reversal stopping device (see 8.6.8.15.7)

(7) for escalator handrail retarding force (see 8.6.8.15.13)

(d) Written procedures for the following:

(1) evacuation procedures for elevators by authorized persons and emergency personnel shall be available on-site (see 8.6.11.5.2 and ASME A17.4)

(2) the procedure for cleaning of a car and hoistway transparent enclosures by authorized persons (see 8.6.11.4.2)

(e) USI(s) of the executable software associated with the relevant functions in 2.26.1.7.1 and 3.26.11.1 [see also 2.26.1.7.3].

(f) The documentation for the engineering test of skirt panels deflection for units installed or altered under A17.1-2019 and later editions [see 8.3.15.3).

8.6.1.2.3 Where a detective part directly affecting the safety of the operation is identified, the equipment shall be taken out of service until the defective part has been adjusted, repaired, or replaced.

8.6.1.3 Maintenance Personnel. Maintenance, repairs, replacements, and tests shall be performed only by elevator personnel [see 1.3].

8.6.1.4 Maintenance Records. Maintenance records shall document compliance with 8.6. Instructions for locating the maintenance records of each unit, for viewing on-site, shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The provided instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in.) high. These records shall be retained for the most recent 5 yr or from the date of installation or adoption of this Code edition, whichever is less or as specified by the authority having jurisdiction. Existing maintenance records up to 5 yr shall be retained.

8.6.1.4.1 On-Site Maintenance Records

(a) *Maintenance Control Program Records*

(1) A record that shall include the maintenance tasks listed with the associated requirements of 8.6 identified in the Maintenance Control Program (8.6.1.2.1), other tests (see 8.6.1.2.2), examinations and adjustments, and the specified scheduled intervals shall be maintained.

(2) The specified scheduled maintenance intervals (see 1.3) shall, as applicable, be based on the criteria given in 8.6.1.2.1(e).

(3) A hard copy of the MCP records shall be viewable on-site by elevator personnel ((~~in either hard copy or electronic format acceptable to the authority having jurisdiction~~)) and shall include, but ((~~are~~)) not be limited to the following:

(a) site name and address

(b) service provider name

(c) conveyance identification (I.D.) and type

(d) date of record

(e) a description of the maintenance task, interval, and associated requirements of 8.6

(f) indication of completion of maintenance task

NOTE: [8.6.1.4.1(a)]: The recommended format for documenting Maintenance Control Program (MCP) records can be found in Nonmandatory Appendix Y. This is only an example format. A specific maintenance MCP that includes all maintenance needs is required for each unit.

(b) *Repair and Replacement Records.* The following repairs and replacements shall be recorded and a hard copy of the repair and replacement record shall be kept on-site for viewing by elevator personnel. ((~~in either hard copy~~)) Records in electronic format may be provided if approved by the *building official*. ((~~or electronic format. Instructions for locating the records of each unit for immediate viewing shall be posted on the controller or at the means necessary for test (see 2.7.6.4).~~)) The provided instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in) in height. The record shall include an explanation of the repair or replacement, date, and name of person(s) and/or firm performing the task. The record of repairs and replacements shall be retained by the owner of the equipment for the most recent 5 yr or from the date of installation or adoption of this Code edition, whichever is less or as specified by the authority having jurisdiction and shall be a permanent record for the installation. ((~~These records may be kept remotely from the site.~~))

(1) Repairs (8.6.2.1 through 8.6.2.5) including repairs of components and devices listed in 8.6.4 through 8.6.10.

(2) Replacements (8.6.3.1 through 8.6.3.11 except 8.6.3.7 and 8.6.3.10) including replacements of components and devices listed in 8.6.4 through 8.6.10.

(3) Where applicable, the USA(s) (2.26.1.7.3) and the associated functions in 2.26.1.7.1 or 3.26.11.1 that are affected.

(c) *Other Records.* The following written records shall be kept on-site for each unit. Instruction for locating the records of each unit. Instructions for locating the records for each unit for immediate viewing shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The provided instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in.) high. These records shall be retained for the most recent 5 yr from of the date of installation or adoption of this Code edition, whichever is less or as specified by the authority having jurisdiction. The record shall include the date and name of person(s) and/or firm performing the task.

(1) A record of oil usage (8.6.5.7).

(2) A record of findings for firefighters' service operation required by 8.6.11.1 with identification of the person(s) that performed the operation.

(3) Periodic tests (see 8.6.1.7) shall be documented or recorded in accordance with 8.6.1.7.2.

(4) Written record to document compliance with replacement criteria specified in ASME A17.6 requirement 1.10.1.1(c).

(d) *Permanent Record.*

(1) A permanent record of the results of all acceptance tests as required by 8.10.1.1.4 and 8.10.1.1.5 shall be kept with the on-site records.

Test tags, complying with 2.16.3.3 for marking plates (except lettering shall be 1.6 mm [0.0625 in]), permanently attached to or adjacent to the controller, shall meet this requirement.

NOTE: This requirement does not apply to equipment installed under ASME A17.1-2010 and earlier editions.

(2) For escalators and moving walks installed or altered under ASME A17.1-2019/CSA B44:19 or later editions, a permanent record of verification of conformance with 6.1.3.3.6 or 6.2.3.3.6 as applicable, for a skirt panel or skirt panel supporting components shall be kept with the on-site maintenance records.

8.6.1.4.2 Call Backs (Trouble Calls). A hard copy record of call backs shall be maintained and shall include the description of reported troubles, dates, time, and corrective action(s) taken that are reported by any means to elevator personnel. These records shall be made available to elevator personnel when performing corrective action. For elevator personnel other than personnel performing the corrective action, records will be available upon request. Instructions on how to report any need for corrective action (trouble calls) to the responsible party shall be posted on the controller or at the means neces-

sary for test (see 2.7.6.4). The instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in.) high.

3029.2 Remote Monitoring and Operation. Elevators and other conveyances found operating with a device that can directly effect a change in its controls from a remote location is prohibited unless it is operated under the direct on-site supervision of a person who is a licensed elevator mechanic in accordance with Section 3003.2.

Note: Remote operation controls, operated by building personnel located within the building, may be installed for security purposes upon prior approval of the *building official.*

CHAPTER 31
SPECIAL CONSTRUCTION

User notes:

About this chapter: *Chapter 31 provides regulations for unique buildings and building elements. Those include buildings such as membrane structures, greenhouses and relocatable buildings. Special elements include pedestrian walkways and tunnels, awnings, canopies and marquees, vehicular gates, solar energy systems, public use restrooms in flood hazard areas, and intermodal shipping containers.*

Code development reminder: *Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 3101
GENERAL

[W] 3101.1 Scope. The provisions of this chapter shall govern special building construction including *membrane structures*, temporary structures, *pedestrian walkways* and tunnels, automatic *vehicular gates*, *awnings* and *canopies*, *marquees*, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, solar energy systems, public use restroom buildings on publicly owned lands in *flood hazard areas*, ((~~and~~)) *intermodal shipping containers*, and fixed guideway transit and passenger rail systems.

SECTION 3102
MEMBRANE STRUCTURES

3102.1 General. The provisions of Sections 3102.1 through 3102.8 shall apply to *air-supported*, *air-inflated*, *membrane-covered cable*, *membrane-covered frame* and tensile *membrane structures*, collectively known as *membrane structures*, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *International Fire Code*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, *greenhouses* and similar facilities not used for human occupancy are required to meet only the requirements of Sections 3102.3.1 and 3102.7. Membrane structures erected on a building, balcony, deck or other structure for any period of time shall comply with this section.

3102.2 Tensile membrane structures and air-supported structures. *Tensile membrane structures* and *air-supported structures*, including permanent and temporary structures, shall be designed and constructed in accordance with ASCE 55. The provisions in Sections 3102.3 through 3102.6 shall apply.

3102.3 Type of construction. *Noncombustible membrane structures* shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an *approved* membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an *approved* membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

Exception: Plastic less than 30 feet (9144 mm) above any floor used in *greenhouses*, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.3.1 Membrane and interior liner material. Membranes and interior liners shall be either noncombustible as set forth in Section 703.3 or meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 and the manufacturer's test protocol.

Exception: Plastic less than 20 mil (0.5 mm) in thickness used in *greenhouses*, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.4 Allowable floor areas. The area of a membrane structure shall not exceed the limitations specified in Section 506.

3102.5 Maximum height. Membrane structures shall not exceed one *story* nor shall such structures exceed the height limitations in feet specified in Section 504.3.

Exception: *Noncombustible membrane structures* serving as roofs only.

3102.6 Mixed construction. Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

3102.6.1 Noncombustible membrane. A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or *atrium* of a building of any type of construction provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

3102.7 Engineering design. The structure shall be designed and constructed to sustain *dead loads*; *loads* due to tension or inflation; *live loads* including wind, snow or *flood* and seismic loads and in accordance with Chapter 16.

3102.7.1 Lateral restraint. For *membrane-covered frame structures*, the membrane shall not be considered to provide lateral restraint in the calculation of the capacities of the frame members.

3102.8 Inflation systems. *Air-supported* and *air-inflated structures* shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

3102.8.1 Equipment requirements. The inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

3102.8.1.1 Auxiliary inflation system. In addition to the primary inflation system, in buildings larger than 1,500 square feet (140 m^2) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

3102.8.1.2 Blower equipment. Blower equipment shall meet all of the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the *building official* to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be *approved*.

[S] 3102.8.2 ((~~Standby~~)) Legally required standby power. Wherever an auxiliary inflation system is required, an *approved* legally required standby power ((~~generating~~)) system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. ((~~Standby~~)) The legally required standby power system shall be capable of operating independently for not less than 4 hours.

3102.8.3 Support provisions. A system capable of supporting the membrane in the event of deflation shall be provided for in *air-supported* and *air-inflated structures* having an *occupant load* of 50 or more or where covering a swimming pool regardless of *occupant load*. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes not less than 7 feet (2134 mm) above the floor, seating area or surface of the water.

SECTION 3103
TEMPORARY STRUCTURES

[S] 3103.1 ((~~General.~~ The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. *Special event structures*, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *International Fire Code*. Those erected for a longer period of time shall comply with applicable sections of this code.)) See Section 106.13.

((~~3103.1.1 Conformance.~~ Temporary structures and uses shall conform to the structural strength, fire safety, *means of egress*, accessibility, light, *ventilation* and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

~~3103.1.2 Permit required.~~ Temporary structures that cover an area greater than 120 square feet (11.16 m^2), including connecting areas or spaces with a common *means of egress* or entrance that are used or intended to be used for the gathering

~~together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a *permit* from the *building official*.~~))

[S] ((~~3103.2 Construction documents.~~ ~~A *permit* application and *construction documents* shall be submitted for each installation of a temporary structure. The *construction documents*, shall include a site plan indicating the location of the temporary structure and information delineating the *means of egress* and the *occupant load*.~~))

[S] ((~~3103.3 Location.~~ ~~Temporary structures shall be located in accordance with the requirements of Table 705.5 based on the *fire-resistance rating* of the *exterior walls* for the proposed type of construction.~~))

[S] ((~~3103.4 Means of egress.~~ ~~Temporary structures shall conform to the *means of egress* requirements of Chapter 10 and shall have an *exit access* travel distance of 100 feet (30 480 mm) or less.~~))

SECTION 3104
PEDESTRIAN WALKWAYS AND TUNNELS

3104.1 General. This section shall apply to connections between buildings such as *pedestrian walkways* or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The *pedestrian walkway* shall not contribute to the *building area* or the number of *stories* or height of connected buildings.

3104.1.1 Application. *Pedestrian walkways* shall be designed and constructed in accordance with Sections 3104.2 through 3104.9. Tunnels shall be designed and constructed in accordance with Sections 3104.2 and 3104.10.

3104.2 Separate structures. Buildings connected by *pedestrian walkways* or tunnels shall be considered to be separate structures.

Exceptions:

1. Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.
2. For purposes of calculating the number of *Type B units* required by Chapter 11, structurally connected buildings and buildings with multiple wings shall be considered to be one structure.

3104.3 Construction. The *pedestrian walkway* shall be of noncombustible construction.

Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. *Fire-retardant-treated wood*, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the *pedestrian walkway* where connected buildings are not less than Type I or II construction.

3104.4 Contents. Only materials and decorations *approved* by the *building official* shall be located in the *pedestrian walkway*.

3104.5 Connections of pedestrian walkways to buildings. The connection of a *pedestrian walkway* to a building shall comply with Section 3104.5.1, 3104.5.2, 3104.5.3 or 3104.5.4.

Exception: Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.

3104.5.1 Fire barriers. *Pedestrian walkways* shall be separated from the interior of the building by not less than 2-hour *fire barriers* constructed in accordance with Section 707 and Sections 3104.5.1.1 through 3104.5.1.3.

3104.5.1.1 Exterior walls. *Exterior walls* of buildings connected to *pedestrian walkways* shall be 2-hour fire-resistance rated. This protection shall extend not less than 10 feet (3048 mm) in every direction surrounding the perimeter of the *pedestrian walkway*.

3104.5.1.2 Openings in exterior walls of connected buildings. Openings in *exterior walls* required to be fire-resistance rated in accordance with Section 3104.5.1.1 shall be equipped with opening protectives providing a not less than 3/4-hour *fire protection rating* in accordance with Section 716.

3104.5.1.3 Supporting construction. The *fire barrier* shall be supported by construction as required by Section 707.5.1.

3104.5.2 Alternative separation. The wall separating the *pedestrian walkway* and the building shall comply with Section 3104.5.2.1 or 3104.5.2.2 where:

1. The distance between the connected buildings is more than 10 feet (3048 mm).
2. The *pedestrian walkway* and connected buildings are equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, and the roof of the walkway is not more than 55 feet (16 764 mm) above grade connecting to the fifth, or lower, *story above grade plane*, of each building.

Exception: *Open parking garages* need not be equipped with an *automatic sprinkler system*.

3104.5.2.1 Passage of smoke. The wall shall be capable of resisting the passage of smoke.

3104.5.2.2 Glass. The wall shall be constructed of a tempered, wired or laminated glass and doors separating the interior of the building from the *pedestrian walkway*. The glass shall be protected by an *automatic sprinkler system* in accordance with Section 903.3.1.1 that, when actuated, shall completely wet the entire surface of interior sides of the wall or glass. Obstructions shall not be installed between the sprinkler heads and the wall or glass. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.

3104.5.3 Open sides on walkway. Where the distance between the connected buildings is more than 10 feet (3048 mm), the walls at the intersection of the *pedestrian walkway* and each building need not be fire-resistance rated provided that both sidewalls of the *pedestrian walkway* are not less than 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and *toxic* gases. The roof of the walkway shall be located not more than 40 feet (12 160 mm) above *grade plane*, and the walkway shall only be permitted to connect to the third or lower *story* of each building.

Exception: Where the *pedestrian walkway* is protected with an automatic sprinkler system in accordance with Section 903.3.1.1, the roof of the walkway shall be located not more than 55 feet (16 764 mm) above *grade plane* and the walkway shall only be permitted to connect to the fifth or lower *story* of each building.

3104.5.4 Exterior walls greater than 2 hours. Where *exterior walls* of connected buildings are required by Section 705 to have a *fire-resistance rating* greater than 2 hours, the walls at the intersection of the *pedestrian walkway* and each building need not be fire-resistance rated provided:

1. The *pedestrian walkway* is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.
2. The roof of the walkway is not located more than 55 feet (16 764 mm) above *grade plane* and the walkway connects to the fifth, or lower, *story above grade plane* of each building.

[S] 3104.6 Public way. *Pedestrian walkways* over a *public way* shall comply with Chapter 32 and the Street Use Ordinance, *Seattle Municipal Code* Title 15.

3104.7 Egress. Access shall be provided at all times to a *pedestrian walkway* that serves as a required *exit*.

3104.8 Width. The unobstructed width of *pedestrian walkways* shall be not less than 36 inches (914 mm). The total width shall be not greater than 30 feet (9144 mm).

3104.9 Exit access travel. The length of *exit access* travel shall be 200 feet (60 960 mm) or less.

Exceptions:

1. *Exit access* travel distance on a *pedestrian walkway* equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 shall be 250 feet (76 200 mm) or less.
2. *Exit access* travel distance on a *pedestrian walkway* constructed with both sides not less than 50 percent open shall be 300 feet (91 440 mm) or less.
3. *Exit access* travel distance on a *pedestrian walkway* constructed with both sides not less than 50 percent open, and equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, shall be 400 feet (122 m) or less.

3104.10 Tunneled walkway. Separation between the tunneled walkway and the building to which it is connected shall be not less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Section 716.

SECTION 3105
AWNINGS AND CANOPIES

[S] ((~~3105.1 General.~~ ~~*Awnings* and *canopies* shall comply with the requirements of Sections 3105.2 and 3105.3 and other applicable sections of this code.~~))

[S] ((~~3105.2 Design and construction.~~ ~~*Awnings* and *canopies* shall be designed and constructed to withstand wind or other lateral *loads* and *live loads* as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. *Awnings* shall have frames of noncombustible material, *fire-retardant-treated wood*, heavy timber complying with Section 2304.11, or 1-hour construction with combustible or noncombustible covers and shall be either fixed, retractable, folding or collapsible.~~))

[S] ((~~3105.3 Awnings and canopy materials.~~ ~~*Awnings* and *canopies* shall be provided with an *approved* covering that complies with one of the following:~~

~~1. The fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.~~

~~2. Has a *flame spread index* not greater than 25 when tested in accordance with ASTM E84 or UL 723.~~

~~3. Meets all of the following criteria when tested in accordance with NFPA 286:~~

~~3.1. During the 40 kW exposure, flames shall not spread to the ceiling.~~

~~3.2. Flashover, as defined in NFPA 286, shall not occur.~~

~~3.3. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.~~

~~3.4. The peak heat release rate throughout the test shall not exceed 800 kW.~~

~~**Exception:** The fire propagation performance and *flame spread index* requirements shall not apply to awnings installed on detached one- and two-family dwellings.~~))

[S] 3105.1 General. All *awnings* and *canopies* are subject to the requirements of this section. A *marquee* is a type of *canopy* and is subject to this section. *Awnings* and *canopies* containing electrical wiring and light fixtures are also subject to the requirements of the *Seattle Electrical Code*. *Awnings* and *canopies* over a public place shall comply with the *Seattle Municipal Code* Title 15, *Street Use Code*.

[S] 3105.2 Definitions. Definitions of "sign" and various types of signs are found in *Seattle Municipal Code*, Title 23, *Land Use Code*, Chapter 23.84A, Definitions, and Chapter 2 of this code.

[S] 3105.3 Permits.

3105.3.1 Permits required. No *awning* or *canopy* shall be erected, constructed, altered or structurally revised without a permit issued by the *building official*. A single permit may be issued for installation of all *awnings* or *canopies*, without signs, serving a multi-tenant building. Structural repairs and replacement of *awning* coverings requires a permit.

Signs installed on *awnings* and *canopies* shall have a separate sign permit for each separate business entity.

Each subsequent installation of an *awning*, *canopy* or sign shall require a separate permit.

Exception: Maintenance which is limited to painting, repainting, cleaning and minor repairs does not require a permit.

3105.3.2 Permit application. To obtain a permit required by this chapter, the applicant shall file an application which includes the following:

1. The address of the proposed *awning* or *canopy* on the building;
2. Specifications, plans and drawings of the structure, site and vicinity plans, and an identification numbering system for the placement of each proposed *awning* or *canopy* on the elevation and plan view drawings;
3. Signature, contact information and City business license number of the building owner;
4. Signature, contact information and City business license number of the business establishment served by the *awning* or *canopy*;
5. Signature, contact information, City business license number, and State contractor or electrical contractor license number of the installer;
6. Electrical connection and illumination information when the *awning* or *canopy* has electrical components; and
7. Permit fee as specified in the *Fee Subtitle*.

[S] 3105.4 Maintenance. Each *awning* and *canopy*, together with their supports, braces, anchors, and signs shall be maintained in good repair and in a proper state of preservation. The surface of all *awnings* and *canopies* shall be kept clean and *awnings* shall be protected with a sealer-type solution. Failure to maintain any *awning*, *canopy* or sign is a violation and subject to the provisions of Section 103 of this code.

[S] 3105.5 Materials. *Awnings* shall have approved *fire-retardant coverings* or shall comply with the requirements in this code for the materials *used*. *Canopy* materials shall meet the standards for the rigid material *used* as required by this code. Frames shall be of materials allowed for the type of construction of the building.

Exception: Aluminum frames are allowed with all construction types.

3105.5.1 Approval of materials. The *building official* is permitted to require that sufficient technical data be submitted to substantiate the proposed *use* of any materials and is allowed to approve their *use* if it is determined that the evidence submitted is satisfactory for the *use* intended.

[S] 3105.6 Welding. All structural welding shall conform to the requirements of Chapter 20 for aluminum and Chapter 22 for steel.

[S] 3105.7 Electric signs and luminaires. All *electric signs* shall comply with *Seattle Electrical Code* Article 600 and Article 410 for luminaires.

[S] 3105.8 Obstruction of exits, light and ventilation. No portion of the surface or support of an *awning* or *canopy*, including a retracted *awning*, shall be erected, constructed or maintained so as to obstruct any fire escape or standpipe, or any window, door or opening used as a *means of egress*, or so as to prevent free passage from one part of a roof to any other part of a roof.

No *awning*, *canopy*, or portion thereof shall be attached in any form, shape or manner to a fire escape or standpipe, nor be placed in any manner that interferes with any opening providing ventilation or light required by Chapter 12 of this *Code*.

[S] 3105.9 Location. All portions of *awnings* and *canopies* shall be at least 8 feet (2438 mm) above any walking surface immediately below. All portions of *awnings* and *canopies* located over public property shall be at least 8 feet (2438 mm) above grade and at least 2 feet (610 mm) from the curb. *Awnings* and *canopies* shall be located where they will not obstruct, obscure or interfere with any publicly maintained street tree, streetlight or utility pole.

[S] 3105.10 Supports. The supports for *awnings* and *canopies* shall be located on private property.

Exception: Where approved by the Director of Transportation, stanchions for *awnings* located at the entrance to buildings are permitted to be installed on public property if they are located in line with other street furniture. Individual stanchions shall have a cross sectional dimension or diameter no greater than 6 inches (152 mm).

[S] 3105.11 Drainage.

3105.11.1 Awning drainage. *Awnings* shall shed water uniformly from the *awning* covering.

3105.11.2 Canopy drainage. *Canopies* draining away from the *building line* shall shed water uniformly over the *canopy* edge. The upper surface of a *canopy* shall be sloped a minimum of 1 unit vertical in 48 units horizontal (2% slope). Approval shall be obtained from the Director of Public Utilities when a *canopy* drains back toward the building and is connected to an infiltration facility, a side sewer or is conveyed under a sidewalk to a gutter.

[S] 3105.12 Design loads. *Awnings* and *canopies* shall be designed and constructed to resist all forces to which they are subject as specified in Chapter 16. Where signs, *electric signs* or luminaires are attached to an *awning* or *canopy* structure, the additional load of all attachments shall be included in the design loads and shall comply with the requirements of Chapter 16 and Section 3107.10.1 of this *Code*.

[S] 3105.13 Pitch. The upper surface of all *awnings* shall have a pitch of at least 30 degrees (0.52 rad) from the horizontal. The *building official* is authorized to approve *awnings* with a smaller pitch when the design is prepared by a licensed structural engineer.

[S] 3105.14 Attachment of awnings and canopies. All *awnings* and *canopies* attached to masonry, concrete, aluminum, or steel shall be safely secured with steel anchors and bolts, or approved expansion bolts of sufficient size and anchorage to support the loads safely. No support or attachment for an *awning* or *canopy* shall be connected to, supported by, or fastened to exterior veneer.

[S] 3105.15 Size. Where an *awning* or *canopy* is located at an exit door from a stairway or *exit passageway* that is fire-resistance rated, the distance the *awning* or *canopy* projects from the building shall be no more than one-half the distance from the walking surface to the lowest point of the bottom of the *awning* or *canopy*.

[S] 3105.16 Approved materials. The *building official* may require that sufficient technical data be submitted to substantiate the proposed *use* of any material; and may approve *use* of the material if the *building official* determined that the evidence submitted is satisfactory for the intended *use*.

[S] 3105.17 Inspections. All *awnings* and *canopies* regulated by this chapter are subject to inspection by the *building official*. The permit holder must request a final inspection within 3 business days of completing the installation.

[S] 3105.18 Footing or foundation inspection. Footings or foundations for *awnings* and *canopies* are subject to inspection by the *building official.* An inspection must be requested and completed before the footing is filled.

[S] 3105.19 Electrical inspection. All electrical wiring is subject to the *Seattle Electrical Code.* Upon energizing any electrical elements, the permit holder must request an inspection within one business day.

SECTION 3106
MARQUEES

[S] 3106.1 General. ((~~*Marquees* shall comply with Sections 3106.2 through 3106.5 and other applicable sections of this code.~~)) *Marquees* are, by definition, a *canopy* and shall comply with Section 3105.

[S] ((~~3106.2 Thickness.~~ ~~The height or thickness of a *marquee* measured vertically from its lowest to its highest point shall be not greater than 3 feet (914 mm) where the *marquee* projects more than two-thirds of the distance from the *lot line* to the curb line, and shall be not greater than 9 feet (2743 mm) where the *marquee* is less than two-thirds of the distance from the *lot line* to the curb line.~~))

[S] ((~~3106.3 Roof construction.~~ ~~Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a *marquee* shall be sloped to downspouts that shall conduct any drainage from the *marquee* in such a manner so as not to spill over the sidewalk.~~))

~~**[S] ((3106.4 Location prohibited.** Every *marquee* shall be so located as not to interfere with the operation of any exterior standpipe, and such that the *marquee* does not obstruct the clear passage of *stairways* or *exit discharge* from the building or the installation or maintenance of street lighting.))~~

~~**[S] ((3106.5 Construction.** A *marquee* shall be supported entirely from the building and constructed of noncombustible materials. *Marquees* shall be designed as required in Chapter 16. Structural members shall be protected to prevent deterioration.))~~

SECTION 3107
SIGNS

~~**[S] ((3107.1 General.** Signs shall be designed, constructed and maintained in accordance with this code.))~~

[S] 3107.1 General. It is the purpose of this section to safeguard the life, health, property and welfare of people within the City by regulating and controlling the design, quality of materials, construction, location, illumination, and maintenance of signs and *sign structures* that are visible from any portion of public places and rights-of-way.

[S] 3107.2 Enforcement.

3107.2.1 Authority. The Director of Transportation and the *building official* shall enforce the provisions of this chapter as it relates to signs located over public places. "Public places" is defined in Section 15.02.046 of the *Seattle Municipal Code*, *Street and Sidewalk Use*. The *building official* shall enforce the provisions of this chapter as it relates to signs located over all other property in the City of Seattle.

3107.2.2 Other requirements. All signs shall comply with any additional sign regulations imposed by *Seattle Municipal Code* Title 23, *Land Use Code*, and Title 15, *Street Use Code*, and other City regulations, even when no permit is required. Signs having electrical wiring and light fixtures are subject to the requirements of the *Seattle Electrical Code*.

[S] 3107.3 Definitions.

3107.3.1 Definitions—Land Use Code. The following sign-related definitions are found in the Seattle *Land Use Code* Chapter 23.84A and are applicable to this section:

ELECTRIC SIGN.

ON-PREMISES SIGN.

PROJECTING SIGN.

ROOF SIGN.

SIGN.

WALL SIGN.

[S] 3107.4 Permits.

3107.4.1 Permits required. Except as otherwise specifically provided in this section, a permit shall be obtained from the *building official* before any sign is erected, constructed, posted, applied, or altered.

A permit must be obtained for:

1. All signs viewable from public rights of way, except signs considered temporary signs by the *Land Use Code* Section 23.55.
2. All *electric signs*.
3. Existing sign when a different business entity seeks to use the sign.
4. Any *display surface* greater than 5 square feet (0.46 m^2) in area.
5. Signs located within the interior of the building that are not visible from the public right-of-way when:
   - 5.1. The sign is mounted within the interior of a covered or open mall of a multi-tenant retail facility and the sign is located over or adjoining the pedestrian walking surface; or
   - 5.2. The sign is greater than 5 square feet (0.46 m^2) in area; or
   - 5.3 It is an *electric sign*.
6. Existing signs that are removed and reinstalled.
7. Signs that are refurbished, retro-fitted, relocated or field-assembled.

3107.4.2 Work exempt from permit. A sign permit is not required for:

1. Changes made to the message copy installed on the *display surface* of a sign when the *sign structure* is lawfully erected and is specifically designed for using manually replaceable copy.

2. Maintenance which is limited to painting, repainting, cleaning and minor repairs where the *display surface* or *sign structure* is not removed or replaced.
3. Signs for public facilities that indicate danger or that provide service or safety information and are not greater than 24 square feet (2.23 square meters).

3107.4.3 Temporary signs. The erection, re-erection, construction, posting or placement of temporary signs that are allowed by Section 23.55.012 of the *Land Use Code* do not require a sign permit. The owner of a temporary sign is responsible for compliance with the provisions of this section and other applicable laws or codes regulating signs, and for the removal of any temporary sign at the end of the allowed term. Failure to comply with the requirements of either this *Code* or the *Land Use Code* is a violation and subject to the provisions of Section 103 of this *Code* and the provisions of Chapter 23.91 of the *Land Use Code.*

3107.4.4 Maximum number of signs. Temporary signs allowed by Section 23.55.012 of the *Land Use Code* and signs not requiring a permit as specified in Section 3107.4.1 of this *Code* are not counted as part of the maximum number of signs allowed under Chapter 23.55 of the *Land Use Code*.

3107.4.5 Attachments to signs. Ancillary devices, displays and attachments, that are not part of the original sign design for which a permit was issued, shall not be added to an existing sign except as provided Chapter 23.55 of the *Land Use Code* and requires a new permit issued by the *building official.*

Where ancillary devices, displays, *electric signs* or luminaires are attached to a *sign structure*, the additional load of all attachments shall be included in the design loads and shall comply with the requirements of Chapter 16 and Section 3107.10 of this *Code*.

[S] 3107.5 Permit application. To obtain a sign permit, the applicant shall submit an application to the Department which provides the following information:

1. The address of the proposed sign installation;
2. Specifications, plans and drawings of the structure, site and vicinity, and a numbering system that identifies the placement of each proposed sign on the elevation and plan view drawings;
3. Signature, contact information and City business license number of the building owner;
4. Signature, contact information and City business license number of the business establishment served by the sign or *awning sign*;
5. Signature, contact information, City business license number, and State contractor or electrical contractor license number of the installer;
6. Electrical connection and illumination information when the sign has electrical components; and
7. Permit fee as specified in the *Fee Subtitle*.

Note: Electrical permits are required for *electric signs* pursuant to the *Seattle Electrical Code*, and street use permits shall be obtained from the Department of Transportation for signs over any public place pursuant to the *Street Use Code*. Review and approval by the Department of Neighborhoods is required for signs located on the site of a *historic building*, or in a *landmark* or special review district.

[S] 3107.6 Inspections. All signs regulated by this chapter are subject to inspection by the *building official*, including sign footings, refurbished or relocated used signs and retrofitted and field-assembled signs. The permit holder must request a final inspection within 3 business days of completing the installation. The *building official* may require an inspection of any temporary sign to ensure public safety.

3107.6.1 Electrical sign inspection. All electrical wiring is subject to the *Seattle Electrical Code.* Upon energizing an *electrical sign*, the permit holder must request an inspection within one business day.

3107.6.2 Sign footing inspection. Footings for all signs greater than 5 square feet (0.46 m^2) in area require a footing inspection. An inspection must be requested and completed before the footing is filled.

[S] 3107.7 Maintenance and closure of business.

3107.7.1 Maintenance. The owners of signs shall maintain their signs, together with all supports, braces, guys and anchors, in good repair and in a proper state of preservation. The owners shall keep *display surfaces* of all signs neatly painted or posted at all times. Failure to maintain any sign, *display surface* or *sign structure* and the component parts is a violation and subject to the provisions of Section 103 of this *Code*.

3107.7.2 Closure of business and abandoned signs. Upon the closure and vacation of a business or activity, the operator of the business or activity is responsible for removing all related signs within 90 days from the date of closure. If the operator fails to remove any sign and the business or activity is not resumed during the 90-day period, then the owner of the

premises upon which the signs are located is responsible and must remove all signs within 180 days from the date of closure and vacation of the business or activity.

Note: A new permit is required for existing signs when a different business entity uses the sign. See Section 3107.4.

[S] 3107.8 Nonconforming signs. Maintenance to keep a nonconforming sign in good condition is required. Minor structural or electrical additions or alterations deemed to be necessary for public safety may be authorized by the *building official.* A nonconforming sign, for the purpose of this C*ode*, is a sign or any portion of a sign which, because of its location or construction, could not lawfully be reconstructed in its present location.

[S] 3107.9 General requirements.

3107.9.1 General. All signs shall conform to the requirements of this section.

3107.9.2 Clearance from overhead electrical conductors. Signs shall be located no closer than 3 feet (914 mm) horizontally or 8 feet (2438 mm) vertically from overhead electrical conductors which are energized at 1000 volts or less and not less than 10 feet (3048 mm) in any direction from overhead conductors energized at more than 1000 volts.

Exception: Overhead conductors enclosed in an approved raceway or enclosure.

3107.9.3 Clearance from fire escapes, exits or standpipes. No sign or *sign structure* shall be erected in such a manner that any portion of its surface or supports will interfere in any way with the free use of any fire escape, exit or standpipe.

3107.9.4 Obstruction of exits, light and ventilation. No portion of the surface or support of any sign shall be erected, constructed or maintained so as to obstruct any fire escape or standpipe, or any window, door or opening used as a *means of egress*, or so as to prevent free passage from one part of a roof to any other part of the roof. No sign, or portion of a sign, shall be attached in any form, shape or manner to a fire escape or standpipe, nor be placed in such a manner as to interfere with any opening providing the ventilation or light required by Chapter 12 of this *Code*.

3107.9.5 Supporting members. Signs mounted on and attached to buildings shall be so designed and mounted that secondary structural members shall be incorporated into and become a part of the sign display. Exterior bracing such as angle irons, guy wires, cables and similar devices are permitted only where no other reasonable method of fastening consistent with safety is possible.

3107.9.6 Non-display surfaces. If a sign is visible from more than one direction, all areas not intended as a *display surface* including the back and sides, shall be designed so the non-*display surfaces* are given a finished appearance and the *display surface* is visible only from the direction that it is intended to be seen.

3107.9.7 Electrical permit sticker. Each *electrical sign* shall display the electrical permit sticker issued with the sign permit. The sticker shall be located where it is clearly visible without use of a ladder and without requiring access into a building, unless otherwise authorized by the *building official*.

3107.9.8 Labels. Every permanent sign shall display the name of the sign erector or manufacturer. Electrical signs must display listing labels required by the *Seattle Electrical Code*.

[S] 3107.10 Design.

3107.10.1 General. Signs and *sign structures* shall be designed and constructed to resist all forces to which they are subject as specified in Chapter 16 and this section. All signs shall be designed and installed to transfer all forces directly to the structural frame of the building or structure. The overturning moment produced from lateral forces shall in no case exceed two-thirds of the dead load resisting moment. Uplifts due to overturning shall be adequately resisted by proper anchorage to the ground or to the structural frame of the building. The weight of earth superimposed over footings is permitted to be used in determining the dead load resisting moment. Such earth shall be carefully placed and thoroughly compacted.

3107.10.2 Wind and seismic loads. Signs and *sign structures* shall be designed and constructed to resist wind and seismic forces as specified in Chapter 16 of this *Code*.

3107.10.3 Allowable stresses. The design of wood, concrete, steel or aluminum members shall conform to the requirements of Chapters 19, 20, 22 and 23. Loads, both vertical and horizontal, exerted on the soil shall not produce stresses exceeding those specified in Chapter 16 of this *Code*. The working stresses of wire rope and its fastenings shall not exceed 25 percent of the ultimate strength of the rope or fasteners.

[S] 3107.11 Construction.

3107.11.1 General. The supports for all signs and *sign structures* shall be placed in or upon private property and shall be securely built, constructed, and erected in conformance with the requirements of this chapter. All structural welding on signs and *sign structures* shall conform to the requirements of Chapter 20 for aluminum and Chapter 22 for steel.

3107.11.2 Materials. Materials for construction of signs and *sign structures* shall be:

1. Of a quality and grade allowed by specific chapters in this *Code* for the materials proposed; or
2. Listed or rated for the proposed *use*; or

3. Approved by the *building official*.

3107.11.3 Approved materials. The *building official* may require that sufficient technical data be submitted to substantiate the proposed *use* of any material; and may approve *use* of the material when the *building official* determines that the evidence submitted is satisfactory for the intended *use*.

3107.11.4 Anchorage. Members supporting unbraced signs shall be so proportioned that the bearing loads imposed on the soil in either direction, horizontal or vertical, shall not exceed the design requirements.

Braced ground signs shall be anchored to resist the specified wind or seismic load acting in any direction. Anchors and supports shall be designed for safe bearing loads on the soil and for an effective resistance to pull-out amounting to a force 25 percent greater than the required resistance to overturning.

Signs attached to masonry, concrete or steel shall be safely and securely fastened thereto by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to support safely the loads applied. No wooden blocks or plugs or anchors with wood used in connection with screws or nails is considered proper anchorage except in the case of signs attached to wood framing.

No lead plugs or anchors shall be used to support signs. No anchor or support of any sign shall be connected to or supported by an unbraced parapet wall unless the wall is designed or braced for the added forces.

[S] 3107.12 Roof signs.

3107.12.1 General. *Roof signs* shall be constructed of approved material as specified in Section 3107.11. The sign shall be secured and anchored to the structural frame of the building.

3107.12.2 Clear passage. A passage clear of all obstructions shall be left under or around, and immediately adjacent to, signs exceeding a height of 4 feet (1219 mm) above the roof. The passage shall not be less than 3 feet (914 mm) wide and 4 feet (1219 mm) high and shall be at parapet or roof level. There shall be one clear passage opening as follows:

1. One for each *roof sign*.
2. One for every 50 lineal feet (15 240 mm) of horizontally running *sign structure*.
3. Within 20 feet (6096 mm) of walls and parapets when *roof signs* are at right angles to a face of the building.

[S] 3107.13 Electrical signs.

3107.13.1 Construction. Structures supporting *electrical signs* shall comply with Section 3107.11 of this *Code*.

3107.13.2 Installation. Electrical signs and branch circuits supplying power to *electric signs* shall be installed in accordance with the Article 600 of the *Seattle Electrical Code*.

3107.13.3 Inspections. The permit holder must request a final inspection within 3 business days of completing the installation or within one business day upon energizing an *electrical sign*.

SECTION 3108
TELECOMMUNICATION AND BROADCAST TOWERS

[BS] 3108.1 General. Towers shall be designed and constructed in accordance with the provisions of TIA 222. Towers shall be designed for seismic *loads*; exceptions related to seismic design listed in Section 2.7.3 of TIA 222 shall not apply. In Section 2.6.6.2 of TIA 222, the horizontal extent of Topographic Category 2, escarpments, shall be 16 times the height of the escarpment.

Exception: Single free-standing poles used to support antennas not greater than 75 feet (22 860 mm), measured from the top of the pole to grade, shall not be required to be noncombustible.

[BS] 3108.2 Location and access. Towers shall be located such that guy wires and other accessories shall not cross or encroach on any street or other public space, or over above-ground electric utility lines, or encroach on any privately owned property without the written consent of the owner of the encroached-upon property, space or above-ground electric utility lines. Towers shall be equipped with climbing and working facilities in compliance with TIA 222. Access to the tower sites shall be limited as required by applicable OSHA, FCC and EPA regulations.

SECTION 3109
SWIMMING POOLS, SPAS AND HOT TUBS

[W] 3109.1 General. The design and construction of swimming pools, spas and ((~~hot tubs~~)) other aquatic recreation facilities shall comply with the *International Swimming Pool and Spa Code*, ((~~.~~)) where the facility is one of the following:

1. For the sole use of residents and invited guests at a single-family *dwelling*;
2. For the sole use of residents and invited guests of a duplex owned by the residents;

3. Operated exclusively for physical therapy or rehabilitation and under the supervision of licensed medical practitioner.

All other "water recreation facilities" as defined in RCW 70.90.110 are regulated under chapters 246-260 and 246-262 WAC.

SECTION 3110
AUTOMATIC VEHICULAR GATES

3110.1 General. *Automatic vehicular gates* shall comply with the requirements of Sections 3110.2 and 3110.3 and other applicable sections of this code.

3110.2 Vehicular gates intended for automation. *Vehicular gates* intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

3110.3 Vehicular gate openers. *Vehicular gate* openers, where provided, shall be *listed* in accordance with UL 325.

SECTION 3111
SOLAR ENERGY SYSTEMS

3111.1 General. Solar energy systems shall comply with the requirements of this section.

3111.1.1 Wind resistance. Rooftop-mounted photovoltaic (PV) panel systems and solar thermal collectors shall be designed in accordance with Section 1609.

3111.1.2 Roof live load. Roof structures that provide support for solar energy systems shall be designed in accordance with Section 1607.14.4.

3111.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with this section, the *International Plumbing Code*, the *International Mechanical Code* and the *International Fire Code*. Where light-transmitting plastic covers are used, solar thermal collectors shall be designed in accordance with Section 2606.12.

3111.2.1 Equipment. Solar thermal systems and components shall be *listed* and *labeled* in accordance with ICC 900/SRCC 300 and ICC 901/SRCC 100.

3111.3 Photovoltaic solar energy systems. Photovoltaic solar energy systems shall be designed and installed in accordance with this section, the *International Fire Code*, NFPA 70 and the manufacturer's installation instructions.

3111.3.1 Equipment. *Photovoltaic panels* and modules shall be *listed* and *labeled* in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Inverters shall be *listed* and *labeled* in accordance with UL 1741. Systems connected to the utility grid shall use inverters *listed* for utility interaction.

3111.3.2 Fire classification. Rooftop-mounted photovoltaic (PV) panel systems shall have a fire classification in accordance with Section 1505.9. Building-integrated photovoltaic (BIPV) systems installed as roof coverings shall have a fire classification in accordance with Section 1505.8.

3111.3.3 Building-integrated photovoltaic (BIPV) systems. BIPV systems installed as roof coverings shall be designed and installed in accordance with Section 1507.

3111.3.4 Access and pathways. Roof access, pathways and spacing requirements shall be provided in accordance with Section 1205 of the *International Fire Code*.

3111.3.5 Ground-mounted photovoltaic systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with Chapter 16 and the *International Fire Code*.

3111.3.5.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the *fire separation distance* requirements determined by the local jurisdiction.

SECTION 3112
GREENHOUSES

3112.1 General. The provisions of this section shall apply to *greenhouses* that are designed and used for the cultivation, maintenance, or protection of plants.

3112.2 Accessibility. *Greenhouses* shall be *accessible* in accordance with Chapter 11.

3112.3 Structural design. *Greenhouses* shall comply with the structural design requirements for *greenhouses* in Chapter 16.

3112.4 Glass and glazing. Glass and glazing used in *greenhouses* shall comply with Section 2405.

3112.5 Light-transmitting plastics. Light-transmitting plastics shall be permitted in lieu of plain glass in *greenhouses* and shall comply with Section 2606.

3112.6 Membrane structures. *Greenhouses* that are membrane structures shall comply with Section 3102.

3112.6.1 Plastic film. Plastic films used in *greenhouses* shall comply with Section 3102.3.

SECTION 3113
RELOCATABLE BUILDINGS

3113.1 General. The provisions of this section shall apply to relocatable buildings. Relocatable buildings manufactured after the effective date of this code shall comply with the applicable provisions of this code.

Exception: This section shall not apply to manufactured housing used as dwellings.

[S] 3113.1.1 Compliance. A newly constructed relocatable building shall comply with the requirements of this code for new construction. An existing relocatable building that is undergoing alteration, addition, change of occupancy or relocation shall comply with ((~~Chapter 14 of the *International Existing Building Code*~~)) Section 313 of the *Seattle Existing Building Code*.

3113.2 Supplemental information. Supplemental information specific to a relocatable building shall be submitted to the authority having jurisdiction. It shall, as a minimum, include the following in addition to the information required by Section 105:

1. Manufacturer's name and address.
2. Date of manufacture.
3. Serial number of module.
4. Manufacturer's design drawings.
5. Type of construction in accordance with Section 602.
6. Design *loads* including: *roof live load*, roof snow *load*, floor *live load*, wind *load* and seismic *site class*, use group and design category.
7. Additional building planning and structural design data.
8. Site-built structure or appurtenance attached to the relocatable building.

3113.3 Manufacturer's data plate. Each relocatable module shall have a data plate that is permanently attached on or adjacent to the electrical panel, and shall include the following information:

1. Occupancy group.
2. Manufacturer's name and address.
3. Date of manufacture.
4. Serial number of module.
5. Design *roof live load*, design floor *live load*, snow *load*, wind and seismic design.
6. *Approved* quality assurance agency or *approved* inspection agency.
7. Codes and standards of construction.
8. Envelope thermal resistance values.
9. Electrical service size.
10. Fuel-burning equipment and size.
11. Special limitations if any.

3113.4 Inspection agencies. The building official is authorized to accept reports of inspections conducted by *approved* inspection agencies during off-site construction of the relocatable building, and to satisfy the applicable requirements of Sections 110.3 through 110.3.12.1.

SECTION 3114
PUBLIC USE RESTROOM BUILDINGS IN FLOOD HAZARD AREAS

Note: Additional Seattle-specific requirements for buildings and structures in the flood hazard area may apply. See Section 106.4, Flood hazard areas, for additional information.

3114.1 General. For the purpose of this section, public restroom buildings are located on publicly owned lands in *flood hazard areas* and intended for public use. Public restroom buildings and portions of other buildings that contain public restrooms are limited to toilet rooms, bathrooms, showers and changing rooms. Public restroom buildings and portions of buildings that

contain public restrooms shall comply with the requirements of this section. Public-use restrooms that are not elevated or *dry floodproofed* in accordance with Section 1612 shall comply with Section 3114.2. Portions of buildings that include uses other than public-use toilet rooms, bathrooms, showers and changing rooms shall comply with Section 1612.

3114.2 Flood resistance. Public-use restrooms on publicly owned lands in *flood hazard areas* shall comply with the requirements of ASCE 24, except for elevation requirements, and shall comply with all of the following criteria:

1. The building footprint is not more than 1,500 square feet (139 m^2).
2. Located, designed and constructed to resist the effects of flood hazards and flood loads to minimize flood damage from a combination of wind and water loads associated with the base flood.
3. Anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy during conditions of the base flood.
4. Constructed of flood-damage-resistant materials.
5. Where enclosed by walls, the walls have flood openings.
6. Mechanical and electrical systems are located above the base flood elevation.
7. Plumbing fixtures and plumbing connections are located above the base flood elevation.
8. An emergency plan, approved by the jurisdiction, is submitted to the building official and includes building design documents specifying implementation of protection measures prior to the onset of flooding conditions.

Exceptions:

1. Minimum necessary electric equipment required to address health, life safety and electric code requirements is permitted below the base flood elevation in accordance with ASCE 24 provisions for electric elements installed below the minimum elevations.
2. Plumbing fixtures and connections are permitted below the base flood elevation provided that the fixtures and connections are designed and installed to minimize or eliminate infiltration of floodwaters into the sanitary sewage system and discharges from sanitary sewage systems into floodwaters.

SECTION 3115
INTERMODAL SHIPPING CONTAINERS

3115.1 General. The provisions of Section 3115 and other applicable sections of this code shall apply to *intermodal shipping containers* that are repurposed for use as buildings or structures, or as a part of buildings or structures.

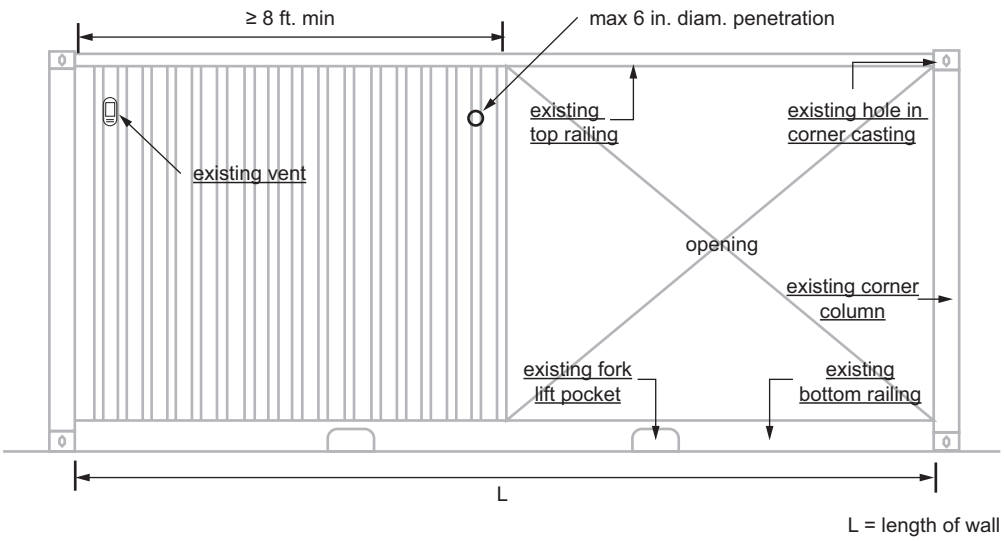
Exceptions:

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with ((~~Chapter 14 of the International Existing Building Code~~)) Section 313 of the *Seattle Existing Building Code*.
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the International Fire Code.
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.
4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3115, provided that they comply with all of the following:
    4.1. Such units shall be single stand-alone units supported at grade level and used only for occupancies as specified under Risk Category I in Table 1604.5.
    4.2. Such units are located a minimum of 8 feet (2438 mm) from adjacent structures, and are not connected to a fuel gas system or fuel gas utility.
    4.3. In hurricane-prone regions and flood hazard areas, such units are designed in accordance with the applicable provisions of Chapter 16.

3115.2 Construction documents. The construction documents shall contain information to verify the dimensions and establish the physical properties of the steel components and wood floor components of the *intermodal shipping container,* in addition to the information required by Sections 107 and 1603.

3115.3 Intermodal shipping container information. Intermodal shipping containers shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an approved agency. A report of the verification process and findings shall be provided to the building owner.

1. Manufacturer's name or identification number.
2. Date manufactured.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 3115.8.5.3(4)
BRACING UNIT DISTRIBUTION—PENETRATION LIMITATIONS

[W] SECTION 3116
FIXED GUIDEWAY TRANSIT AND PASSENGER RAIL SYSTEMS

[W] 3116.1. Construction. Construction of fixed guideway transit and passenger rail systems shall be in accordance with NFPA 130-2020, standard for fixed transit and passenger rail systems, as modified in Section 3116.2.

[W] 3116.2 Modifications to NFPA 130.

Note: An asterisk is used throughout Section 3116 to reference material provided in the annex of NFPA 130-2020, Standard for Fixed Transit and Passenger Rail Systems. This information not part of the adopted code.

[W] 3.3 General Definitions.

3.3.44.2 Traction power substation (TPSS): A TPSS is an electrical substation consisting of switchgear transformers/rectifiers. Emergency trip equipment, and other systems that converts AC electric power provided by the electrical power industry for public utility service to DC voltage to supply light rail vehicles with traction current.

[S] 4.4 Fire Scenarios.

4.4.1.1 Emergency power assumptions. The emergency power requirements in this standard assume a fire or other emergency event within the station or trainway concurrent with a power outage of the primary source of electrical power unrelated to the event within the transit system.

[S] 5.1 General.

5.1.2.3 Fixed guideway transit and passenger rail stations shall comply with the applicable provisions of Section 1114.

5.1.3.1.1 Fixed guideway transit and passenger rail stations are classified as Group A, Division 3 occupancies in accordance with the 2021 Seattle Building Code and 2021 Seattle Fire Code.

[W][S] 5.2 Construction.

5.2.1.1 During the course of construction, provisions of NFPA 241 and Chapter 33 of the 2021 Seattle Fire Code and Chapter 33 of the 2021 Seattle Building Code ((~~shall~~)) apply. ((~~except as modified herein.~~))

5.2.2.2 Construction types shall conform to the requirements in ((~~NFPA 220~~)) International Building Code, Chapter 6, unless otherwise exempted in this ((~~standard~~)) section.

[W] Table 5.2.2.1
Minimum Construction Requirements for New Station Structures

Station Configuration	Construction Type†
Stations Erected entirely above grade and in a separate building:	
Open stations	Type IIB
Enclosed stations	Type IIA
Stations erected entirely or partially below grade:	
Open above grade portions of below grade structures*	Type IIA
Below grade portions of structures	Type IB
Below grade structures with occupant loads exceeding 1000	Type IA

* Roofs not supporting an occupancy above are not required to have a fire resistance rating.

† Construction types are in accordance with ((~~NFPA 220~~)) the International Building Code.

5.2.4.1 Interconnected Floor Levels. Interconnection between floor levels in stations shall be permitted as follows:

(1) *Stairs and escalators regularly used by passengers for circulation during normal revenue service in enclosed stations equipped throughout with an automatic sprinkler system ((~~shall not be~~)) are not required to be fire-separated if the station is constructed in accordance with Chapter 7 of the 2021 *Seattle Building Code*. All required exit stairs in enclosed stations shall be enclosed in accordance with Chapter 10 of the 2021 *Seattle Building Code*.

(2) Public areas on different levels in open stations are permitted to be interconnected.

(3) Public areas on different levels in enclosed stations shall be permitted to be interconnected, provided fire separation is not required for smoke control or other fire protection purposes.

5.2.4.2* Separation Between Public and Nonpublic Floor Areas. All public areas shall be fire-separated from adjacent nonpublic areas by 5.2.4.3 through 5.2.4.5.

5.2.4.3 Ancillary Spaces. Fire resistance ratings of separations between ancillary occupancies shall be established as required for accessory occupancies and incidental uses by ((~~NFPA 101~~)) the International Building Code and in accordance with ASTM E119 and ANSI/UL 263.

5.2.5.4 Materials used as interior finish in open stations shall comply with the requirements of ((~~NFPA 101, Chapter 12~~)) International Building Code, Chapter 8.

[W][S] 5.3 Means of Egress.

5.3.1.1 The provisions for means of egress for a station shall comply with ((~~Chapters 7 and 12 of NFPA 101~~)) the International Building Code, Chapter 10, except as herein modified.

5.3.2.1* The occupant load for a station shall be based on the train load of trains simultaneously entering the station on all tracks in normal traffic direction plus the simultaneous entraining load awaiting trains. For below grade (including retained cut) stations, the calculated *occupant load* derived from the analysis above cannot be less than the *occupant load* based upon one occupant per 7 sq. ft. (net) applied to the platforms.

(1) The train load shall consider only one train at any one track, inside a station.

(2) The basis for calculating train and entraining loads shall be the peak period ridership figures as projected for design of a new system or as updated for an operating system

5.3.2.2.1 Where station occupancy is anticipated to be greater than design capacity during a major event the operating agency shall initiate approved measures to restrict access to the station, when required by the *fire code official*, to ensure existing *means of egress* are adequate as an alternate to account for peak ridership associated with major events.

5.3.2.4 ((~~Where~~)) If an area within a station is intended for use by other than passengers or employees, the following parameters shall apply:

(1) The occupant load for that area shall be determined in accordance with the provisions of ((~~NFPA 101~~)) the *International Building Code* as appropriate for the use.

(2) The additional occupant load shall be included in determining the required egress from that area.

(3) The additional occupant load shall be permitted to be omitted from the station occupant load where the area has independent means of egress of sufficient number and capacity.

5.3.3.4 Travel Distance. For open stations ((~~The~~)) the maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not exceed 100 m (325 ft). For enclosed stations the travel distance to an exit shall not exceed 76 m (250 ft.).

5.3.3.6 Alternate Egress. At least two means of egress remote from each other shall be provided from each station platform as follows:

(((~~(1)* A means of egress used as a public circulation route shall be permitted to provide more than 50 percent of the required egress capacity from a station platform or other location.~~

~~2~~)) (1) Means of egress from separate platforms shall be permitted to converge.

(((~~(3)~~))) (2) Where means of egress routes from separate platforms converge, the subsequent capacity of the egress route shall be sufficient to maintain the required evacuation time from the incident platform.

5.3.3.8 Required *interior exit stairways* in enclosed stations serving floor levels more than 30 feet (9144 mm) below its *level of exit discharge*, except those regularly used by passengers shall comply with the requirements for a pressurized stairway in Section 909.20.5 of the 2021 *Seattle Building Code*.

5.3.5.4. Not adopted.

5.3.5.5. Not adopted.

5.3.5.6. Not adopted.

5.3.5.7. Not adopted.

5.3.5.8. Not adopted.

5.3.5.9. Not adopted.

5.3.5.10. Not adopted.

5.3.6 Elevators. Not adopted.

5.3.7* Doors, Gates, Security Grilles and Exit Hatches.

5.3.7.1 The egress capacity for doors and gates in a means of egress serving public areas shall be computed as follows:

(1) ((~~60~~)) Sixty people per minute (p/min) for single leaf doors and gates

(2)* 0.0819 p/mm-min (2.08 p/in.-min) for bi-parting multileaf doors and gates measured for the clear width dimension.

5.3.7.2 Gates in a means of egress shall be designed in accordance with the requirements for doors serving as a means of egress in accordance with Section 1010.3.4.1 of the 2021 *Seattle Building Code* and maintain the clear width of the exit walkway.

5.3.7.2.1 Security grilles are allowed when designed and operated in accordance with the IBC.

5.3.8 Fair Barriers.

5.3.8.5 Turnstile-type fare barriers shall be permitted in accordance with ((~~NFPA *101*~~)) Chapter 10 of the 2021 *Seattle Building Code* and shall be permitted in the means of egress and shall meet the following criteria:

(1) Dimensions shall be in accordance with the requirements of ((~~NFPA *101*~~)) Chapter 10 of the 2021 *Seattle Building Code*.

(2) Turnstiles that drop away from the egress opening under the conditions listed in 5.3.8.2 or 5.3.8.3 shall be credited with a capacity of 50 p/min for egress calculations.

(3) Turnstiles that revolve freely in the direction of egress under the conditions listed in 5.3.8.2 shall meet the following criteria:

(a) Each unit shall be credited with a capacity of 25 p/min for egress calculations.

(b) The turnstiles shall not account for more than 50 percent of the required egress capacity for each egress route.

[5.3.9* Horizontal Exits. Horizontal exits ((~~compliant with NFPA 101~~)) shall ((~~be permitted for up to 100 percent of the number of exits and require egress capacity provided that not more than 50 percent of the number and required capacity is into a single building~~)) comply with *International Building Code* Section 1026.

5.3.11 Means of Egress Lighting.

5.3.11.1 Illumination of the means of egress in stations, including escalators that are considered a means of egress, shall be in accordance with ((~~Section 7.8 of NFPA 101~~)) International Building Code Section 1008.

5.3.11.2 Means of egress, including escalators considered as means of egress, shall be provided with a system of emergency lighting in accordance with ((~~Section 7.9 of NFPA 101~~)) International Building Code Section 1008.

[W][S] 5.4 Fire Protection

5.4.1* Fire Command Center.

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with NFPA 72 and Section 508 of the 2021 *Seattle Fire Code*.

5.4.2 Fire Alarm Systems

5.4.2.5 When activated, fire alarm, smoke detection, valve switches, and waterflow signals shall be transmitted simultaneously to the local station and to the operations control center. (See also Chapter 10). An operations Control Center per 9.6 shall be used to supervise these systems and devices.

5.4.4 Automatic Fire Suppression Systems.

5.4.4.1* An automatic sprinkler ((~~protection~~)) system shall be provided ((~~in areas used for concessions, in storage areas, in trash rooms, and other similar areas with combustible loadings, except trainways~~)) throughout enclosed stations.

Exceptions:

1. Traction power substation (TPSS) when located in a transformer vault designed in accordance with the NFPA 70.
2. Other high voltage equipment located in a transformer vault designed in accordance with the NFPA 70 when approved by the *fire code official*.
3. *Fire command centers*, unoccupied communication room(s), and unoccupied signal rooms when protected with *clean agent* fire suppression and separated from other spaces with two-hour fire rated construction.
4. Other rooms, critical to station operation, when protected with alternative automatic fire-extinguishing systems and separated from other spaces with two-hour fire rated construction, when approved by the fire code official.

5.4.4.1.1 An *automatic sprinkler system* shall be provided in areas of open stations used for concessions, markets, storage areas and similar areas with combustible loadings, and in trash rooms, electrical rooms, mechanical rooms, machinery rooms, communication rooms, and other enclosed rooms.

Exceptions:

1. Stations at grade with less than 1,500 sq. ft. of ancillary area/ancillary space.
2. *Fire command centers*, unoccupied communication room(s), and unoccupied signal rooms when protected with alternative *automatic fire-extinguishing systems* and separated from other spaces with two-hour fire rated construction.
3. Other rooms, critical to station operation, when protected with *clean agent* fire suppression and separated from other spaces with two-hour fire rated construction, when *approved* by the *code official*.

5.4.4.2 Sprinkler protection shall be permitted to be omitted in areas of open stations ((~~remotely located from public spaces~~)) separated from the station by a distance of 20 feet, where allowed by the *fire code official*.

5.4.4.5 Other fire suppression systems, if approved, shall be permitted to be substituted for automatic sprinkler systems in the areas listed in 5.4.4.1 and 5.4.4.1.1.

5.4.5 Standpipe and Hose Systems.

5.4.5.1* Class I standpipes shall be installed in enclosed stations in accordance with ((~~NFPA 14~~)) *International Fire Code* Section 905 except as modified herein and any other area as required by the *fire code official*.

5.4.5.3.1 Hydraulic design information signs shall be provided at each fire department connection indicating the residual inlet pumping pressure(s) required for the hydraulically most remote and/or other selected hose connection outlet location(s).

5.4.5.4 Standpipes shall be permitted to be of the dry type with the approval of the authority having jurisdiction provided the following requirements are met:

1. Systems shall be installed in a manner so that the water is delivered to all hose connections on the system in 10 minutes or less.
2. Combination air relief-vacuum valves shall be installed at each high point in the system.

   Exception: Combination air relief-vacuum valves are not required at fire department connections located at a high point of the system.

5.4.5.8 The standpipe system shall be designed to provide 1000 gpm at 130 psi. The 1000 gpm consists of the two most remote hose connections flowing 500 gpm each.

5.4.5.9 Isolation valves on the standpipe are permitted to be locked in the open position in lieu of being electronically monitored.

5.4.5.10 Pressure regulating devices are not required per Section 7.2.3.2 of NFPA 14.

5.4.6 Portable Fire Extinguishers. Portable fire extinguishers in such number, size, type, and location ((~~as determined by the authority having jurisdiction~~)) shall be provided in accordance with the *International Fire Code* Section 906.

5.4.6.1 Where required, portable fire extinguishers shall be selected, installed, inspected, tested, and maintained in accordance with NFPA 10. Portable fire extinguishers are not required in public areas of at-grade stations.

5.4.7 Ventilation.

5.4.7.1 Emergency ventilation shall be provided in enclosed stations in accordance with Chapter 7 and the *International Building Code* Section 909.

5.4.7.1.1 Smoke control system. A smoke control system shall be provided in underground fixed guideway transit and passenger rail stations in accordance with Section 909 of the 2021 *Seattle Building Code*. Smoke control shall restrict movement of smoke to the general area of fire origin and non-occupied exhaust areas and maintain tenability in the means of egress.

5.4.8 Emergency Power Supply System (EPSS)

5.4.8.1 ((~~Emergency power~~)) A Class 2, Type U or 10, Level 1 Emergency Power Supply System (EPSS) in accordance with Article 700 of NFPA 70 and Chapter 4 of NFPA 110 shall be provided for underground and enclosed stations.

5.4.8.5 Systems connected to the emergency power system shall include the following and shall comply with rules promulgated by the *fire code official*:

(1) Emergency lighting
(2) Protective signaling systems
(3) Emergency communication system
(4) Fire command center
(5) Elevators providing required egress capacity [see 5.3.6.4(5)]

CHAPTER 32
ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

User note:

About this chapter: *From time to time it is necessary or appropriate for a portion of a building to encroach onto an adjoining public right-of-way. Chapter 32 establishes parameters for such encroachments not only at grade but also above and below grade.*

SECTION 3201
GENERAL

3201.1 Scope. The provisions of this chapter shall govern the encroachment of structures into the public right-of-way.

3201.2 Measurement. The projection of any structure or portion thereof shall be the distance measured horizontally from the *lot line* to the outermost point of the projection.

3201.3 Other laws. The provisions of this chapter shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

[S] ((~~3201.4 Drainage.~~ ~~Drainage water collected from a roof, *awning*, *canopy* or *marquee*, and condensate from mechanical equipment shall not flow over a public walking surface.~~))

[S] 3201.4 Approval of encroachments. All encroachments of buildings and structures on, over or under sidewalks, streets and other public places are subject to approval by the Director of Transportation and the *building official*. Encroachments shall comply with this code and other applicable codes including Seattle Municipal Code, Title 15.

[S] 3201.5 Doors and gates. No door or gate in any position shall project over public property.

[S] 3201.6 Materials. Structures and appendages regulated by this code shall be constructed of materials specified in this code for structures on private property.

[S] ((~~SECTION 3202~~
~~ENCROACHMENTS~~

~~**3202.1 Encroachments below grade.** Encroachments below grade shall comply with Sections 3202.1.1 through 3202.1.3.~~

~~**3202.1.1 Structural support.** A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the *lot lines*, except that the footings of street walls or their supports that are located not less than 8 feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street *lot line*.~~

~~**3202.1.2 Vaults and other enclosed spaces.** The construction and utilization of vaults and other enclosed spaces below grade shall be subject to the terms and conditions of the applicable governing authority.~~

~~**3202.1.3 Areaways.** *Areaways* shall be protected by grates, *guards* or other *approved* means.~~

~~**3202.2 Encroachments above grade and below 8 feet in height.** Encroachments into the public right-of-way above grade and below 8 feet (2438 mm) in height shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.~~

~~**3202.2.1 Steps.** Steps shall not project more than 12 inches (305 mm) and shall be guarded by *approved* devices not less than 3 feet (914 mm) in height, or shall be located between columns or pilasters.~~

~~**3202.2.2 Architectural features.** Columns or pilasters, including bases and moldings, shall not project more than 12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than 4 inches (102 mm).~~

~~**3202.2.3 Awnings.** The vertical clearance from the public right-of-way to the lowest part of any *awning*, including valances, shall be not less than 7 feet (2134 mm).~~

~~**3202.3 Encroachments 8 feet or more above grade.** Encroachments 8 feet (2438 mm) or more above grade shall comply with Sections 3202.3.1 through 3202.3.4.~~

~~**3202.3.1 Awnings, canopies, marquees and signs.** *Awnings*, *canopies*, *marquees* and signs shall be constructed so as to support applicable *loads* as specified in Chapter 16. *Awnings*, *canopies*, *marquees* and signs with less than 15 feet (4572 mm) of clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk~~

~~measured from the building. Stanchions or columns that support *awnings*, *canopies*, *marquees* and signs shall be located not less than 2 feet (610 mm) in from the curb line.~~

~~**3202.3.2 Windows, balconies, architectural features and mechanical equipment.** Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than 8 feet (2438 mm), 1 inch (25 mm) of encroachment is permitted for each additional 1 inch (25 mm) of clearance above 8 feet (2438 mm), but the maximum encroachment shall be 4 feet (1219 mm).~~

~~**3202.3.3 Encroachments 15 feet or more above grade.** Encroachments 15 feet (4572 mm) or more above grade shall not be limited.~~

~~**3202.3.4 Pedestrian walkways.** The installation of a *pedestrian walkway* over a public right-of-way shall be subject to the approval of the applicable governing authority. The vertical clearance from the public right-of-way to the lowest part of a *pedestrian walkway* shall be not less than 15 feet (4572 mm).~~

~~**3202.4 Temporary encroachments.** Where allowed by the applicable governing authority, vestibules and storm enclosures shall not be erected for a period of time exceeding 7 months in any 1 year and shall not encroach more than 3 feet (914 mm) nor more than one-fourth of the width of the sidewalk beyond the street *lot line*. Temporary entrance awnings shall be erected with a clearance of not less than 7 feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other *approved* noncombustible support.~~))

CHAPTER 33

SAFEGUARDS DURING CONSTRUCTION

User notes:

About this chapter: *While the balance of the chapters in this code specify how a building is to be designed and constructed in order to be in compliance with the code, Chapter 33 looks to the actual construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. This chapter also addresses the need for a fire watch during nonworking hours for certain buildings once the construction has progressed significantly. Issues such as how to provide egress while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed.*

Code development reminder: *Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 3301
GENERAL

3301.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

3301.2 Storage and placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

[BS] 3301.2.1 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment *loads* that will be encountered during installation of the system. **

SECTION 3302
CONSTRUCTION SAFEGUARDS

3302.1 Alterations, repairs and additions. Required *exits*, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during *alterations*, *repairs* or *additions* to any building or structure.

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the existing building is not occupied.

3302.2 Manner of removal. Waste materials shall be removed in a manner that prevents injury or damage to persons, adjoining properties and public rights-of-way.

3302.3 Fire safety during construction. Fire safety during construction shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *International Fire Code*.

SECTION 3303
DEMOLITION

3303.1 Construction documents. *Construction documents* and a schedule for demolition shall be submitted where required by the *building official*. Where such information is required, work shall not be done until such *construction documents* or schedule, or both, are *approved*.

[S] 3303.2 Pedestrian protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter and the Street Use Ordinance, *Seattle Municipal Code* Title 15.

3303.3 Means of egress. A *horizontal exit* shall not be destroyed unless and until a substitute *means of egress* has been provided and *approved*.

[S] ((~~3303.4 Vacant lot.~~ ~~Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.~~))

[S] 3303.4 Surface condition and fill. The site shall be left level and free of debris upon completion of demolition, and all holes shall be filled or protected with secure fences. Holes are permitted to be filled with concrete, rocks or other nondecaying material no larger than 12 inches (305 mm) in diameter. Wood and other organic material shall not be buried on the site.

Leaving the site level means:

1. The grade conforms to that existing on all sides;
2. Surface water will drain off;
3. Surface is smooth; and
4. Broken sections of the foundation or other material are not exposed.

The site shall be seeded upon completion of the demolition if it is to be left vacant for more than 6 months.

3303.5 Water accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

[S] 3303.6 Utility connections. Service utility connections shall be discontinued and capped in accordance with ((~~the approved rules and the requirements of the applicable governing authority~~)) requirements of the governing utility or agency including, but not limited to, Seattle Public Utilities, Seattle Department of Transportation, Seattle Fire Department, Seattle City Light, Puget Sound Energy and CenturyLink.

3303.7 Fire safety during demolition. Fire safety during demolition shall comply with the applicable requirements of this code and the applicable provisions of *Chapter 33* of the *International Fire Code*.

[S] 3303.8 Removal of hazardous and combustible materials. All asbestos and other hazardous material shall be removed prior to demolition, in accordance with regulations of the Environmental Protection Agency, the Puget Sound Clean Air Agency and other pertinent agencies. Combustible waste shall be removed in accordance with the *International Fire Code*. During demolition, streets and sidewalks shall be left clean at the end of each day's operation.

[S] 3303.9 Welding and cutting. Welding and cutting shall be performed in accordance with the *International Fire Code*.

[S] 3303.10 Erosion and sediment control. Provision shall be made to stabilize ground conditions to eliminate dust and erosion. Demolition sites shall comply with *Seattle Municipal Code* Title 22 Subtitle VIII, the *Seattle Stormwater Code* and *Seattle Municipal Code* Chapter 22.170, the *Seattle Grading Code*.

[S] 3303.11 Drainage. If the demolition will result in a change of drainage patterns, the flow of all watercourses, including streams, ditches, drains, combined sewers and runoff, intercepted during the progress of the work, shall be returned to the condition present before the demolition or as specified on the permit, and in accordance with *Seattle Municipal Code* Title 22 Subtitle VIII, the *Seattle Stormwater Code* and *Seattle Municipal Code* Chapter 22.170, the *Seattle Grading Code*, respectively.

[S] 3303.12 Foundations and footings. All concrete or masonry floors, foundations, footings, basement walls and retaining walls not to be reused shall be removed to 18 inches (457 mm) below final grade. All concrete floors left in place shall be broken so as to allow water to drain through unless the floors are to be used.

[S] 3303.13 Engineer's report. The *building official* is permitted to require a structural engineer's analysis of proposed demolition or any portions of a structure remaining after demolition.

[S] 3303.14 Underground tanks. When demolition occurs, all underground tanks on the site shall either be removed or filled, as required by the *International Fire Code*.

[S] 3303.15 Rat eradication program. All applicants for a demolition permit shall initiate a rat eradication program on the project site at least 15 days prior to the start of demolition or any clearing or grading activity on the demolition site.

Exception: Subject to approval of the *building official*, the requirements of the rat eradication program may be reduced or waived for projects which an emergency order or hazard correction order has been issued pursuant to Section 102.

[S] 3303.15.1 Duration of rat eradication program. The rat eradication program must continue at least until demolition begins. No demolition or clearing or grading on the demolition site shall begin until the rat eradication program is complete unless approved by the *building official*. The rat eradication program may be terminated or waived by the *building official* when supported by a written recommendation of a licensed pest control agent.

[S] 3303.15.2 Requirements of rat eradication program. The rat eradication program shall be approved by a qualified pest control agent and shall comply with the Seattle–King County Public Health Department guidelines and recommendations for rat baiting. The use of any pesticide shall comply with WAC 16-228-1380. The *building official* may require additional deterrent measures on recommendation of the Seattle-King County Public Health Department.

[S] 3303.15.3 Demolition permit. The *building official* shall not issue any demolition permit until the applicant has provided a copy of the rat eradication program and a declaration that the requirements of Section 3303.15 have been or will be complied with prior to the start of demolition.

SECTION 3304
SITE WORK

3304.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of not less than 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms that have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

3304.1.1 Slope limits. Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the *building official*.

3304.1.2 Surcharge. Fill or other surcharge *loads* shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional *loads* caused by the fill or surcharge. Existing footings or foundations that can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement.

[S] ((~~3304.1.3 Footings on adjacent slopes.~~ ~~For footings on adjacent slopes, see Chapter 18.~~))

3304.1.4 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with Section 1804.6. *Special inspections* of compacted fill shall be in accordance with Section 1705.6.

SECTION 3305
SANITARY

[S] 3305.1 Facilities required. Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

SECTION 3306
PROTECTION OF PEDESTRIANS

[S][BS] 3306.1 Protection required. ((~~Pedestrians shall be protected during construction, remodeling and demolition activities as required by this chapter and Table 3306.1. Signs shall be provided to direct pedestrian traffic.~~)) The protection of the public and of the sidewalks, streets and other public property during construction or demolition shall be provided as required by the Street Use Ordinance, *Seattle Municipal Code* Title 15.

[S] ((~~TABLE 3306.1~~
~~PROTECTION OF PEDESTRIANS~~

~~HEIGHT OF CONSTRUCTION~~	~~DISTANCE FROM CONSTRUCTION TO LOT LINE~~	~~TYPE OF PROTECTION REQUIRED~~
~~8 feet or less~~	~~Less than 5 feet~~	~~Construction railings~~
	~~5 feet or more~~	~~None~~
~~More than 8 feet~~	~~Less than 5 feet~~	~~Barrier and covered walkway~~
	~~5 feet or more, but not more than one-fourth the height of construction~~	~~Barrier and covered walkway~~
	~~5 feet or more, but between one-fourth and one-half the height of construction~~	~~Barrier~~
	~~5 feet or more, but exceeding one-half the height of construction~~	~~None~~

~~For SI: 1 foot = 304.8 mm.~~))

[S] ((~~[BS] 3306.2 Walkways.~~ ~~A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a *building* entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be *accessible* in accordance with Chapter 11 and shall be designed to support all imposed loads, and the design *live load* shall be not less than 150 pounds per square foot (psf) (7.2 kN/m^2).~~))

[S] ((~~[BS] 3306.3 Directional barricades.~~ ~~Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.~~))

[S] ((~~[BS] 3306.4 Construction railings.~~ ~~Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.~~))

[S] ((~~[BS] 3306.5 Barriers.~~ ~~Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.~~))

[S] ((~~[BS] 3306.6 Barrier design.~~ ~~Barriers shall be designed to resist *loads* required in Chapter 16 unless constructed as follows:~~

1. ~~Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.~~
2. ~~The barrier material shall be boards not less than 3/4-inch (19.1 mm) thick or *wood structural panels* not less than 1/4-inch (6.4 mm) thick.~~
3. ~~Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.~~
4. ~~Wood structural use panels 1/4 inch (6.4 mm) or 5/16 inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.~~
5. ~~Wood structural use panels 3/8 inch (9.5 mm) or 1/2 inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center provided that a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.~~
6. ~~Wood structural use panels 5/8 inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).~~))

[S] ((~~[BS] 3306.7 Covered walkways.~~ ~~Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed *loads*. The design *live load* shall be not less than 150 psf (7.2 kN/m^2) for the entire structure.~~

~~**Exception:** Roofs and supporting structures of covered walkways for new, *light-frame construction* not exceeding two *stories* above grade plane are permitted to be designed for a *live load* of 75 psf (3.6kN/m^2) or the *loads* imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:~~

1. ~~Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.~~
2. ~~Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.~~
3. ~~Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.~~
4. ~~Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.~~
5. ~~The deck shall be planks not less than 2 inches (51 mm) thick or *wood structural panels* with an exterior exposure durability classification not less than 23/32 inch (18.3 mm) thick nailed to the joists.~~
6. ~~Each post shall be knee braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.~~
7. ~~A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.~~))

[S] ((~~[BS] 3306.8 Repair, maintenance and removal.~~ ~~Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The *owner* or the *owner's* authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.~~))

[S] ((~~[BS] 3306.9 Adjacent to excavations.~~ ~~Every excavation on a site located 5 feet (1524 mm) or less from the street *lot line* shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street *lot line*, a barrier shall be erected where required by the *building official*. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.~~))

SECTION 3307
PROTECTION OF ADJOINING PROPERTY

[S][BS] 3307.1 Protection required. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. ((~~The person making or causing an excavation to be made shall provide written notice to the *owners* of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.~~)) When the existing grade of a site is altered by filling, excavating, dredging or moving of earth materials, the *owner* shall protect all adjoining property during construction from

encroachment or collapse by sloping the sides of the temporary grading at a slope that is safe and not more than one horizontal to one vertical. In addition, adjoining property shall be protected from encroachment or collapse by sloping the sides of the permanent grading at a slope not greater than two horizontal to one vertical. The *building official* is authorized to approve temporary or permanent slopes that are steeper based on a design by an experienced geotechnical engineer.

In areas of known unsuitable soils, the *building official* is authorized to require slopes that are less steep to assure protection of adjoining property.

[S][BS] 3307.2 Reserved. ((~~Excavation retention systems.~~ ~~Where a retention system is used to provide support of an excavation for protection of adjacent *structures*, the system shall conform to the requirements in Sections 3307.2.1 through 3307.2.3.~~

~~**[BS] 3307.2.1 Excavation retention system design.** Excavation retention systems shall be designed by a *registered design professional* to provide vertical and lateral support.~~

~~**[BS] 3307.2.2 Excavation retention system monitoring.** The retention system design shall include requirements for monitoring of the system and adjacent structures for horizontal and vertical movement.~~

~~**[BS] 3307.2.3 Retention system removal.** Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by backfill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.~~))

SECTION 3308
TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

((~~**3308.1 Storage and handling of materials.** The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.~~))

[S] 3308.1 General. Temporary use of streets, alleys and public property shall comply with the Street Use Ordinance, Seattle Municipal Code Title 15.

((~~**3308.1.1 Obstructions.** Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.~~))

[S] ((~~**3308.2 Utility fixtures.** Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.~~))

SECTION 3309
FIRE EXTINGUISHERS

[F] 3309.1 Where required. Structures under construction, *alteration* or demolition shall be provided with not fewer than one *approved* portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each *stairway* on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 3309.2 Fire hazards. The provisions of this code and the *International Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 3310
MEANS OF EGRESS

3310.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent *stairway* shall be provided. As construction progresses, such *stairway* shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3310.2 Maintenance of means of egress. *Means of egress* and required *accessible means of egress* shall be maintained at all times during construction, demolition, remodeling or *alterations* and *additions* to any building.

Exception: Existing *means of egress* need not be maintained where *approved* temporary *means of egress* systems and facilities are provided.

[S] 3310.3 Stairway floor number signs. Temporary stairway floor number signs shall be provided in accordance with the requirements of Section 1023.9.

SECTION 3311
STANDPIPES

[F] 3311.1 Where required. In buildings required to have standpipes by Section 905.3.1, not fewer than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to *stairways* complying with Section 3310.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3311.2 Buildings being demolished. Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 3311.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

SECTION 3312
AUTOMATIC SPRINKLER SYSTEM

[S][F] 3312.1 Completion before occupancy. In buildings where an *automatic sprinkler system* is required by this code, it shall be unlawful to occupy any portion of a building or structure until the *automatic sprinkler system* installation has been tested and *approved*, ((~~except as provided in Section 111.3~~)) unless *approved* by the *building official*.

[F] 3312.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 3313
WATER SUPPLY FOR FIRE PROTECTION

[F] 3313.1 Where required. An *approved* water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

Exception: The *fire code official* is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] 3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] 3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] 3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a *fire separation distance* of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a *fire separation distance* of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an

existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] 3313.4 Vertical construction, Types I and II construction. If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] 3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the *fire separation distance*, where a standpipe is required in accordance with Section 3311, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

SECTION 3314
FIRE WATCH DURING ((~~CONSTRUCTON~~)) CONSTRUCTION

[W][F] 3314.1 Fire watch. Where required by the *fire code official* or the site safety plan established in accordance with *Seattle Fire Code* Section 3303.1, a fire watch shall be provided for building demolition and for building construction.

EXCEPTION: New construction that is built under the IRC.

3314.1.1 Fire watch during combustible construction. A fire watch shall be provided during nonworking hours for construction that exceeds 40 feet (12 192 mm) in height above the lowest adjacent grade at any point along the building perimeter, for new multistory construction with an aggregate area exceeding 50,000 square feet (4645 m^2) per story or as required by the fire code official.

[S] SECTION 3315
CONSTRUCTION MATERIAL MANAGEMENT

[S] 3315.1 Storage and handling of materials. Materials stored and handled on site during construction shall comply with the manufacturer's printed instructions. Where manufacturer's printed instructions are not available, approved standards or guidelines shall be followed.

[S] 3315.2 Construction phase moisture control. Porous or fibrous materials and other materials subject to moisture damage shall be protected from moisture during construction. Material damaged by moisture or that is visibly colonized by fungi either prior to delivery or during construction shall be cleaned and dried or, where damage cannot be corrected by such means, shall be removed and replaced.

CHAPTER 35

REFERENCED STANDARDS

User note:

About this chapter: The International Building Code® *contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

AA.

Aluminum Association
1400 Crystal Drive, Suite 430
Arlington, VA 22202

ADM—2020. Aluminum Design Manual
1604.3.5, 2002.1

ASM 35—00. Aluminum Sheet Metal Work in Building Construction (Fourth Edition)
2002.1

AAMA.

American Architectural Manufacturers Association
1900 E Golf Road, Suite 1250
Schaumburg, IL 60173

711—20. Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
1404.4

714—19. Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal around Exterior Wall Openings in Buildings
1404.4

1402—09. Standard Specifications for Aluminum Siding, Soffit and Fascia
1403.5.1

2502—19. Comparative Analysis Procedure for Window and Door Products
1709.5

AAMA/WDMA/CSA 101/I.S.2/A440—17. North American Fenestration Standard/Specification for Windows, Doors, and Skylights
1709.5.1, 2405.5

ACI.

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

117—10. Specification for Tolerances for Concrete Construction and Materials
1901.7.1

216.1—14. Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

318—19. Building Code Requirements for Structural Concrete
722.2.4.3, 1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11, 1810.3.11.1, 1810.3.12, 1810.3.13, 1901.2, 1901.3, 1902.1, 1903.1, 1904.1, 1904.2, 1905.1, 1905.1.1, 1905.1.2, 1905.1.3, 1905.1.4, 1905.1.5, 1905.1.6, 1905.1.7, 1905.1.8, 1908.1, 2108.3, 2206.1

550.5—18. Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions
Table 1705.3

[S] 561-21. Assessment, Repair and Rehabilitation of Existing Concrete Structures
405.1.1

ASCE/SEI.

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191

[W] 7—16 ((~~with Supplement 1~~)). Minimum Design Loads and Associated Criteria for Buildings and Other Structures <u>with Supplement No. 1, Supplement No. 2, and Supplement No. 3</u>
202, Table 1504.2, 1602.1, Table 1604.3, 1604.5, Table 1604.5, 1604.8.2, 1604.9, 1605.1, 1605.1.1, 1605.2, 1606.3, 1607.9.1, 1607.9.1.1, 1607.9.1.2, 1607.10, 1607.14.1, 1607.17, 1608.1, 1608.2, Figure 1608.2(1), 1608.3, 1609.1.1, 1609.2, 1609.3, Figure 1609.3(5), Figure 1609.3(6), Figure 1609.3(7), Figure 1609.3(8), Figure 1609.3(9), Figure 1609.3(10), Figure 1609.3(11), Figure 1609.3(12), 1609.5.1, 1609.5.3, 1611.1, 1611.2, 1612.2, 1613.1, 1613.2.2, 1613.2.3, Table 1613.2.3(1), Table 1613.2.3(2), 1613.2.5, 1613.2.5.1, 1613.2.5.2, 1613.3, 1614.1, 1615.1, 1705.13, 1705.13.1.1, 1705.13.1.2, 1705.13.4, 1705.14.1.1, 1705.14.1.2, 1705.14.2, 1705.14.3, 1705.14.4, 1709.5, 1709.5.3.1, 1802.1, 1803.5.12, 1806.1, 1808.3, 1808.3.1, 1809.13, 1810.3.1.1, 1810.3.6.1, 1810.3.8, 1810.3.9.2, 1810.3.9.4, 1810.3.9.4.1, 1810.3.9.4.2, 1810.3.11.2, 1810.3.12, 1902.1, 1905.1.2, 1905.1.7, 1905.1.8, 2205.2.1.1, 2205.2.1.2, 2205.2.2, 2206.2.1, 2209.1, 2209.2, 2210.2, 2211.1.1.1, Table 2304.6.1, Table 2306.3(3), Table 2308.7.5, 2404.1, 2505.1, 2505.2, 2506.2.1

<u>[W] 7—22. Minimum Design Loads and Associated Criteria for Buildings and Other Structures</u>
<u>1615.1</u>

8—02. Standard Specification for the Design of Cold-formed Stainless Steel Structural Members
1604.3.3, 2210.1, 2210.2

19—16. Structural Applications of Steel Cables for Buildings
2208.1

24—14. Flood Resistant Design and Construction
1202.4.2, 1202.4.4, 1612.2, 1612.4, 2702.1.8, 3001.3

29—17. Standard Calculation Methods for Structural Fire Protection
722.1

32—01. Design and Construction of Frost Protected Shallow Foundations
1809.5

49—12. Wind Tunnel Testing for Buildings and Other Structures
1609.1.1

55—16. Tensile Membrane Structures
3102.2

ASHRAE.

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329 USA

170—2017. Ventilation of Health Care Facilities
1020.6

ASME.

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016

A17.1—2019/CSA B44—19. Safety Code for Elevators and Escalators
907.3.3, 911.1.6, 1009.4.1, 1607.11.1, 3001.2, Table 3001.3, 3001.4, 3001.5, 3002.5, 3003.2, 3007.1, 3008.1.4, 3008.7.1

A17.7—2007/CSA B44—07 (R2017). Performance-based Safety Code for Elevators and Escalators
Table 3001.3, 3001.5, 3002.5

A18.1—2020. Safety Standard for Platform Lifts and Stairway Chairlifts
1110.9, Table 3001.3

A90.1—2015. Safety Standard for Belt Manlifts
Table 3001.3

REFERENCED STANDARDS

NFPA—continued

10—2018. Standard for Portable Fire Extinguishers
906.2, Table 906.3(1), Table 906.3(2), 906.3.2, 906.3.4

11—16. Standard for Low-, Medium, and High Expansion Foam
904.7

12—15. Standard on Carbon Dioxide Extinguishing Systems
904.8, 904.13

12A—18. Standard on Halon 1301 Fire Extinguishing Systems
904.9

13—19. Standard for Installation of Sprinkler Systems (except 9.3.6.3(5))
403.3.3, 712.1.3.1, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.13, 905.3.4, 907.6.4, 1019.3

13D—19. Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes
903.3.1.3

13R—19. Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies
903.3.1.2, 903.3.5.2, 903.4

14—19. Standard for the Installation of Standpipe and Hose System
905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

16—19. Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems
904.7, 904.13

17—2021. Standard for Dry Chemical Extinguishing Systems
904.6, 904.13

17A—2021. Standard for Wet Chemical Extinguishing Systems
904.5, 904.13

20—19. Standard for the Installation of Stationary Pumps for Fire Protection
412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

30—21. Flammable and Combustible Liquids Code
415.6.1, 415.6.2, 507.8.1.1.1, 507.8.1.1.2

30A—21. Code for Motor Fuel Dispensing Facilities and Repair Garages
406.2.9.2

31—20. Standard for the Installation of Oil-burning Equipment
2113.15

32—16. Standard for Dry Cleaning Facilities
415.9.3

40—19. Standard for the Storage and Handling of Cellulose Nitrate Film
409.1

45—19. Standard on Fire Protection Laboratories Using Chemicals
428.3.7

58—20. Liquefied Petroleum Gas Code
415.9.2

61—20. Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities
426.1

70—20. National Electrical Code
108.3, 406.2.7, 406.2.9, 412.5.7, 415.11.1.8, Table 509.1, 904.3.1, 907.6.1, 909.12.2, 909.16.3, 910.4.6, 1204.4.1, 2701.1, 2702.1.3, 3111.3

72—19. National Fire Alarm and Signaling Code
407.4.4.5, 407.4.4.5.1, 901.6, 903.4.1, 904.3.5, 907.1.2, 907.2, 907.2.6, 907.2.9.3, 907.2.11, 907.2.13.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.5.2.2.5, 907.6, 907.6.1, 907.6.2, 907.6.6, 907.7, 907.7.1, 907.7.2, 911.1.6, 917.1, 2702.2.4, 3005.5, 3007.7

80—19. Standard for Fire Doors and Other Opening Protectives
410.2.5, 509.4.2, 716.1, 716.2.5.1, 716.2.6.4, 716.2.9, 716.3.4.1, 716.3.5, 716.4.3, 1010.3.3

82—19. Standard on Incinerators and Waste and Linen Handling Systems and Equipment
713.13

85—19. Boiler and Combustion System Hazards Code
426.1

NFPA—continued

92—18. Standard for Smoke Control Systems
909.7, 909.8

99—21. Health Care Facilities Code
407.11, 422.6, 425.1

101—21. Life Safety Code
1030.6.2

105—19. Standard for Smoke Door Assemblies and Other Opening Protectives
405.4.2, 710.5.2.2, 716.2.10, 909.20.4.1

110—19. Standard for Emergency and Standby Power Systems
2702.1.3

111—19. Standard on Stored Electrical Energy Emergency and Standby Power Systems
2702.1.3

120—20. Standard for Fire Prevention and Control in Coal Mines
426.1

[W] 130—20: Standard for Fixed Guideway Transit and Guideway Transit and Passenger Rail Systems
3101.1, 3116

170—18. Standard for Fire Safety and Emergency Symbols
1025.2.6.1

211—19. Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances
2112.5

221—21. Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls
706.2, Table 716.1(2)

252—17. Standard Methods of Fire Tests of Door Assemblies
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.1.2, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

253—19. Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
406.2.4, 424.2, 804.2, 804.3

257—17. Standard for Fire Test for Window and Glass Block Assemblies
Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4

259—18. Standard Test Method for Potential Heat of Building Materials
2603.4.1.10, 2603.5.3

265—19. Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls
803.5.1, 803.5.1.1

268—19. Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
1405.1.1.1, 1405.1.1.1.1, 1405.1.1.1.2, 2603.5.7

275—17. Standard Method of Fire Tests for the Evaluation of Thermal Barriers
508.4.4.1, 509.4.1.1, 1406.10.2, 1408.10.2, 2603.4

276—19. Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components
1508.1, 2603.3, 2603.4.1.5

285—19. Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components
718.2.6, 1402.5, 1406.10.3, 1408.10.4, 1511.6.2, 2603.5.5

286—15. Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
402.6.4.4, 424.2, 803.1.1, 803.1.1.1, 803.11, 803.12, 803.13, 1406.10.2, 1408.10.3, 2603.7, 2603.9, 2604.2.4, 2614.4, 3105.3

288—17. Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal in Fire-resistance-rated Floor Systems
712.1.13.1

289—19. Standard Method of Fire Test for Individual Fuel Packages
402.6.2, 402.6.4.5, 424.2, 806.4

409—16. Standard for Aircraft Hangars
412.3.6, Table 412.3.6, 412.3.6.1, 412.5.5

UL—continued

1040—1996. Fire Test of Insulated Wall Construction—with Revisions through April 2017
1406.10.2, 2603.9

1256—02. Fire Test of Roof Deck Construction—with Revisions through August 2018
1508.1, 2603.3, 2603.4.1.5

1479—2015. Fire Tests of Penetration Firestops
202, 714.4.1.2, 714.4.2, 714.5.1.2, 714.5.4

1482—2011. Solid-fuel Type Room Heaters—with Revisions through August 2015
2112.2, 2112.5

1489—2016. Fire Resistant Pipe Protection Systems Carrying Combustible Liquids
403.4.8.2

1703—2002. Flat-plate Photovoltaic Modules and Panels—with Revisions through September 2018
1507.17.5, 3111.3.1

1715—97. Fire Test of Interior Finish Material—with Revisions through April 2017
1406.10.2, 2603.9, 2614.4

1741—2010. Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources—with Revisions through February 2018
3111.3.1

1777—2007. Chimney Liners—with Revisions through April 2014
2113.11.1, 2113.19

1784—2015. Air Leakage Tests of Door Assemblies
405.4.3, 710.5.2.2, 710.5.2.2.1, 716.2.1.4, 716.2.9.1, 716.2.9.3, 3006.3, 3007.6.3, 3008.6.3

1897—2015. Uplift Tests for Roof Covering Systems
1504.4.1, 1504.4.3

1975—06. Fire Tests for Foamed Plastics Used for Decorative Purposes
402.6.2, 402.6.4.5, 424.2

1994—2015. Luminous Egress Path Marking Systems
411.6, 1008.2.1, 1025.2.1, 1025.2.3, 1025.2.4, 1025.2.5, 1025.4

2034—2017. Single- and Multiple-station Carbon Monoxide Alarms—with Revisions through September 2018
915.4.2, 915.4.4

2075—2013. Standard for Gas and Vapor Detectors and Sensors—with Revisions through December 2017
915.5.1, 915.5.3

2079—2015. Tests for Fire Resistance of Building Joint Systems
202, 715.3.1, 715.8

[W] 2196—2017. Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
909.20.7.1, 913.2.2, 2702.3, ((~~3007.8.1~~)) 403.6.2.9, 3008.8.2

2200—2012. Stationary Engine Generator Assemblies—with Revisions through October 2015
2702.1.1

2202—2009. Electric Vehicle (EV) Charging System Equipment—with Revisions through February 2018
406.2.7

2594—2016. Electric Vehicle Supply Equipment
406.2.7

2703—2014. Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-plate Photovoltaic Modules and Panels—with Revisions through December 2019
1505.9

7103—19. Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings
Table 1504.2, 1507.16.6

61730-1—2017. Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction
1507.16.6, 1507.17.5, 3111.3.1

61730-2—2017. Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing
1507.16.6, 1507.17.5, 3111.3.1

ARTICLE 80
Administration

Informational note: Article 80 is comprised entirely of amendments made by The City of Seattle to the National Electrical Code (NEC). It aligns the administration and enforcement of this Code with administrative chapters found in other construction codes adopted by The City of Seattle.

I. Title, Purpose and Scope

80.1 Title.
These regulations shall be known as the "*Seattle Electrical Code*," may be cited as such, and are referred to herein as "this Code." All references to the *National Electrical Code* contained in this Code mean the *Seattle Electrical Code*.
(A) Referenced Codes. The code provisions and standards referenced in this *Code* are considered part of this *Code* to the extent prescribed by each such reference. Where differences occur between provisions of this *Code* and referenced codes and standards, the provisions of this *Code* govern.

(B) Metric Units. Whenever in this *Code* there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

80.2 Purpose.
(A) Protection from Hazards. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation, or equipment or systems utilizing electricity within the City.
This *Code* is intended to provide for and promote the health, safety, and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this *Code*.
This *Code* is not intended as a design specification nor an instruction manual for untrained persons.

(B) Chapter 296-46B Washington Administrative Code. An additional purpose of this *Code* is to provide equal, higher, or better standards of construction and equal, higher, or better standards of materials, devices, appliances, and equipment than those required by the State of Washington under the provisions of Revised Code of Washington (RCW) Chapter 19.28. Only those sections of the Washington State Electrical Code amending the 2023 National Electric Code, as set forth at Chapter 296-46B of the Washington Administrative Code (hereinafter WAC) and specifically incorporated in this Code are adopted. Informational Notes providing the WAC rule number, as the source of the Seattle amendment, are informational only.

80.3 Scope.
This Code applies to the installation, *alteration,* repair, relocation, replacement, addition to, use, or maintenance of electrical wiring, systems, and equipment, including communications systems and traffic management systems, within the City. The design and testing of *equipment* regulated by this Code are subject to the approval of the authority having jurisdiction.

(A) Traffic Management Systems. Traffic management systems provide signalization for controlling vehicular traffic, pedestrian traffic, or rolling stock. 2020 WAC 296-46B-010(15) through (22) are adopted as follows:

Traffic Management Systems.
(15) The department or city authorized to do electrical inspections will perform the electrical inspection and acceptance of traffic management systems within its jurisdiction. A traffic management system includes:
(a) Traffic illumination systems;
(b) Traffic signal systems;
(c) Traffic monitoring systems;

(d) The electrical service cabinet and all related components and equipment installed on the load side of the service cabinet supplying electrical power to the traffic management system; and
(e) Signalization system(s) necessary for the operation of a light rail system.
(f) A traffic management system can provide signalization for controlling vehicular traffic, pedestrian traffic, or rolling stock.

(16) The department or city authorized to do electrical inspections recognizes that traffic signal conductors, pole and bracket cables, signal displays, traffic signal controllers/cabinets and associated components used in traffic management systems are acceptable for the purpose of meeting the requirements of chapter 19.28 RCW provided they conform with the following standards or are listed on the Washington state department of transportation (WSDOT) qualified products list.

(a) WSDOT/APWA standard specifications and plans;
(b) WSDOT Design Manual;
(c) International Municipal Signal Association (IMSA);
(d) National Electrical Manufacturer's Association (NEMA);
(e) Federal Standards 170/Controller Cabinets;
(f) Manual for Uniform Road, Bridge, and Municipal Construction;
(g) Institute of Transportation Engineers (ITE); or
(h) Manual of Uniform Traffic Control Devices (MUTCD).

(17) Associated induction detection loop or similar circuits will be accepted by the department or city authorized to do electrical inspections without inspection.

(18) For the licensing requirements of chapter 19.28 RCW, jurisdictions will be considered owners of traffic management systems when doing electrical work for another jurisdiction(s) under a valid interlocal agreement, as permitted by chapter 39.34 RCW. Interlocal agreements for traffic management systems must be filed with the department or city authorized to do electrical inspections prior to work being performed for this provision to apply.

(19) Jurisdictions, with an established electrical inspection authority, and WSDOT may perform electrical inspection on their rights of way for each other by interlocal agreement. They may not perform electrical inspection on other rights of way except as allowed in chapter 19.28 or 39.34 RCW.

(20) Underground installations.

(a) In other than open trenching, raceways will be considered "fished" according to the NEC and do not require visual inspection.

(b) The department or city authorized to do electrical inspections will conduct inspections in open trenching within its jurisdiction. The electrical work permit purchaser must coordinate the electrical inspection. A written request (e.g., letter, email, fax, etc.) for inspection, made to the department or city authorized to do electrical inspections office having the responsibility to perform the inspection, must be made a minimum of two working days prior to the day inspection is needed (e.g., two working days 10:00 a.m. Tuesday request for a 10:00 a.m. Thursday inspection, excluding holidays and weekends).

If, after proper written request, the department or city authorized to do electrical inspections fails to make an electrical inspection at the time requested, underground conduit may be covered after inspection by the local government jurisdiction's project inspector/designee. Written documentation of a local government jurisdiction inspection must be provided to the department or city authorized to do electrical inspections when requested. Written documentation will include:

i. Date and time of inspection;
ii. Location;

iii. Installing firm;
iv. Owner;
v. Type of conduit;
vi. Size of conduit;
vii. Depth of conduit; and
viii. Project inspector/designee name and contact information.

(21) Identification of traffic management system components. Local government jurisdictions or WSDOT may act as the certifying authority for the safety evaluation of all components.

(a) An electrical service cabinet must contain only listed components. The electrical service cabinet enclosure is not required to be listed but will conform to the standards in subsection (17) of this section.

(b) The local government jurisdiction must identify, as acceptable, the controller cabinet or system component(s) with an identification plate. The identification plate must be located inside the cabinet and may be attached with adhesive.

(22) Conductors of different circuits in same cable, enclosure, or raceway. All traffic management system circuits will be permitted to occupy the same cable, enclosure, or raceway without regard to voltage characteristics, provided all conductors are insulated for the maximum voltage of any conductor in the cable, enclosure, or raceway.

(B) Interlocal Agreement. Pursuant to the licensing requirements of RCW chapter 19.28, jurisdictions are considered owners of traffic management systems when doing electrical work for another jurisdiction(s) under a valid interlocal agreement, as allowed by RCW chapter 39.34:

(1) Interlocal agreements for traffic management systems must be filed with the department or city authorized to do electrical inspections prior to work being performed.

(2) The City of Seattle, as the authority having jurisdiction to perform electrical inspections, and WSDOT may perform electrical inspections for each other on their rights-of-way by interlocal agreement. They may not perform electrical inspection on other rights-of-way except as allowed in RCW chapters 19.28 or 39.34.

(C) Installations Not Covered. This Code does not cover the following:

(1) Installations in ships and watercraft not connected to public utilities, railway rolling stock, aircraft or automotive vehicles. Installations of railways or generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes.

(2) Installations of communication equipment under exclusive control of communication utilities, located outdoors or in building spaces used exclusively for such installations.

(3) Installations under the exclusive control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in buildings used for such purposes or leased by the utility or on public highways, streets, roads, or other public ways, or outdoors on established rights on private property up to the service point as defined in this Code. The installation and maintenance of all utility owned conductors up to the service point, as defined by this Code, shall be the responsibility of the serving utility.

(4) Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable.

(D) Vesting of electrical permit applications. An electrical permit application shall be considered under the Seattle Electrical code in effect on a date vesting occurs pursuant to as provided below, or on a date as otherwise required by law.

(1) Electrical permit applications shall be considered under the Seattle Electrical Code in effect on the date vesting occurs pursuant to Seattle Building Code Section 101.3 if any of subsections (a) through (c) apply:

(a) The electrical permit application is for work directly associated with a building permit and is submitted separately from the building permit application; or

(b) The electrical permit application is for initial tenant alterations and is submitted no later than 18 months after the date of the approved final inspection for the building, and is submitted before the expiration date of the building permit for the Tenant alteration, as determined by Seattle Building Code Section 106.9; or

(c) Electrical permit applications other than those subject to Item 1 shall be considered under the codes in effect on the date a complete electrical permit application is submitted that complies with all the requirements of Section 80.51.

80.4 Application to Existing Electrical Systems.

(A) Additions, Alterations, Renovations, or Repairs. Additions, *alterations,* renovations, or repairs may be made to any electrical system without requiring the existing electrical system to comply with the requirements of this Code, if the addition, *alteration,* renovation, or repair conforms to the standards required for a new electrical system. Additions, *alterations,* renovations, or repairs shall not cause an existing system to become *unsafe,* unhealthy, or overloaded. This section does not limit the effect of applicable retroactive ordinances.

Exception: Subject to the approval of the authority having jurisdiction, repairs may be made with the same materials of which the building or structure is constructed, other than for the replacement of receptacles as provided in NEC Section 406.4(D), provided the repair complies with the electrical code in effect at the time of original installation and provided further that no change shall be permitted which increases its hazard.

(B) Existing Electrical Installations. Electrical systems lawful at the time of the adoption of this *Code* may continue in use, be maintained or repaired, or have components replaced if the use, maintenance, repair, or component replacement occurs in accordance with system design and specifications of the original system, and no hazard to life, health, or property is likely to result.
If changes are required for correction of hazards, the authority having jurisdiction may approve a compliance schedule for such work.

Informational Note: WAC 296-46B-010(14) requirements for adding, altering, or repairing electrical installations in existing buildings are incorporated herein with edits.

(C) Changes in Building Occupancy. Electrical systems that are part of a building or structure undergoing a change in occupancy as defined in the *Seattle Building Code* shall comply with all requirements of this Code that are applicable to the new occupancy group or use.

(D) Maintenance. All electrical systems, materials, *equipment,* appurtenances, and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices or safeguards that were required by a code in effect when the electrical system was installed shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent shall be responsible for maintenance of electrical systems and *equipment.*

(E) Moved Buildings. Electrical permits for electrical work performed on a building or structure moved into or within the City shall be obtained from the authority having jurisdiction. The authority having jurisdiction will inspect the electrical system for deficiencies and issue corrections. Deficiencies shall be corrected before a certificate of occupancy is issued.

The service to a moved building or structure shall comply with this *Code*. Other than the service, a building or structure moved into or within the City is not required to comply with this *Code* if the original occupancy classification of the building or structure is not changed. A building or structure that undergoes a substantial alteration as defined in Section 304.1.1 of the *Seattle Existing Building Code* and a building or structure wired by standards other than those recognized by this *Code* and the *National Electrical Code* shall comply with this *Code*.

Any moved building that is not in compliance within one year from the date of permit issuance and is found to be a public nuisance may be abated.

Informational Note: For the definition of Occupancy Classification, see Chapter 3 of the Seattle Building Code.

(F) Landmarks—Historic Buildings and Structures. The authority having jurisdiction may modify the specific requirements of this *Code* as it applies to landmarks and require in lieu thereof alternate requirements that, in the opinion of the authority having jurisdiction, will result in a reasonable degree of safety to the public and the occupants of those buildings.

For purposes of this *Code,* a landmark building is a building or structure:

(1) that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making changes to specific features or characteristics;

(2) that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation;

(3) that has been designated for preservation by the State of Washington or by the City Landmarks Preservation Board;

(4) that has been listed or determined eligible to be listed in the National Register of Historic Places; or

(5) located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

80.6 Utilization Equipment and Alternative Material and Methods of Wiring.
This *Code* does not prevent the use of any utilization equipment, material, method, or design of wiring not specifically allowed or prohibited by this *Code*, provided the same has been approved and its use authorized by the authority having jurisdiction.

The authority having jurisdiction may approve an alternative, provided the proposed alternative complies with the provisions of this Code and the alternative, when considered together with other safety features or relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety, and sanitation.

The authority having jurisdiction may require that sufficient evidence or proof be submitted to substantiate any claims regarding the use or suitability of utilization equipment, material, method, or design of wiring. The authority having jurisdiction may, but is not required to, record the approval of alternative materials and methods, and any relevant information, in the files of the authority having jurisdiction or on the approved construction documents or permit.

80.7 Modifications.

The authority having jurisdiction may grant modifications for individual cases whenever there are practical difficulties involved in carrying out the provisions of this *Code*. Prior to granting any modifications, the authority having jurisdiction must first find that:

(1) the strict application of this *Code* is impractical under the circumstances;

(2) the modification is in conformity with the intent and purpose of this *Code*;

(3) the modification does not lessen any fire protection requirements;

(4) the modification does not lessen any degree of structural integrity.

80.8 Tests.

Whenever there is insufficient evidence of compliance with the provisions of this *Code* or evidence that any material or method of construction does not conform to the requirements of this *Code*, the authority having jurisdiction may require tests to establish compliance. The permit applicant is responsible for paying the costs of the testing.

Test methods shall be as specified in this *Code* or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the authority having jurisdiction shall determine the test procedures.

All tests shall be conducted by an *approved* agency. Reports of such tests shall be retained by the authority having jurisdiction until the permit receives final approval.

II. Organization and Enforcement

80.10 Authority.

(A) Jurisdiction of Department of Construction and Inspections. The Department of Construction and Inspections is authorized to administer, interpret, and enforce this *Code* and is referred to throughout this *Code* as the "authority having jurisdiction." The Department of Construction and Inspections is under the administrative and operational control of the Director.

Whenever the term or title "Electrical Code Official," "Administrative Authority," "Responsible Official," "Chief Inspector," or "Code Enforcement Officer" is used in this *Code*, it means the authority having jurisdiction (AHJ).

(B) Designees. The authority having jurisdiction is authorized to appoint such officers, inspectors, assistants, and other employees as needed. The authority having jurisdiction may authorize such employees as may be necessary to carry out the functions of the Department of Construction and Inspections.

(C) Right of Entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the authority having jurisdiction may enter a building or premises at any reasonable time to perform the functions authorized by this *Code*.

(D) Authority to Disconnect Utilities in Emergencies. The authority having jurisdiction has the authority to disconnect or order discontinuance of any utility service or energy supply to buildings, structures, or equipment regulated by this *Code* in cases of emergency where necessary to eliminate an imminent hazard to life or property. The authority having jurisdiction may enter any building or premises to disconnect utility service or energy supply. The authority having jurisdiction shall, wherever possible, notify the serving utility, owner, and occupant of the building, structure, or premises of the decision to disconnect prior to taking such action, and shall notify the serving utility, owner, and occupant of the building, structure, or premises in writing of such disconnection immediately thereafter.

Utility service shall be discontinued until the equipment, appliances, devices, or wiring found to be defective or defectively installed are removed or restored to a safe condition.
It shall be unlawful for any person to reconnect any electrical equipment disconnected by the authority having jurisdiction or to connect to an alternative source of energy, fuel, or power supply until the equipment is placed in a safe condition and is approved by the authority having jurisdiction.

(E) Connection After Order to Disconnect. No person shall make connections from any energy, fuel or power supply nor supply energy or fuel to any equipment regulated by this *Code* that has been disconnected or ordered to be disconnected by the authority having jurisdiction, or the use of which has been ordered to be discontinued by the authority having jurisdiction until the authority having jurisdiction authorizes the reconnection and use of such equipment.

(F) Liability. Nothing contained in this Code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City or its officers, employees, or agents, for any injury or damage resulting from the failure of a building to conform to the provisions of this *Code*, or by reason or as a consequence of any inspection, notice, order, certificate, permission, or approval authorized or issued or done in connection with the implementation or enforcement of this *Code*, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this *Code* by its officers, employees or agents.

This *Code* shall not be construed to relieve or lessen the responsibility of any person owning, operating, or controlling any building or structure for any damages to persons or property caused by defects, nor shall the Department of Construction and Inspections or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this *Code* or any permits or certificates issued under this *Code*.

Neither the authority having jurisdiction nor any employee charged with the enforcement of this *Code* shall be personally liable for any damage that accrues to persons or property because of any act or omission committed in the discharge of their duties, provided that the authority having jurisdiction or employee acted in good faith and without malice.

(G) Code Interpretation or Explanation. Electrical inspectors may give information as to the meaning or application of the National Electrical Code, as amended by the Seattle Electrical Code, but shall not lay out work or act as consultants for contractors, owners, or users.

(H) Cooperation of Other Officials and Officers. The authority having jurisdiction may request, and shall receive as far as may be necessary in the discharge of duties, the assistance and cooperation of other officials of the City of Seattle and officers of public and private utilities.

80.11 Responsibility for Compliance.
Responsibility for compliance with the requirements of this Code shall be the obligation of the owner of the building, structure, or premises, the duly authorized agent of the owner, or other person responsible for the condition or work, and not of the City or any of its officers or employees.

80.12 Unsafe Conditions.
(A) Unsafe Conditions or Code Violations. The authority having jurisdiction may inspect any new or existing electrical installation or equipment, and if the installation or equipment is found to be maintained or used in an unsafe condition or found to be in violation of this Code, the authority having jurisdiction is authorized to serve upon the owner, agent, or other person responsible for the condition a notice or order stating the required correction. Any person served such notice who fails to comply with the order therein shall be in violation of this ordinance and subject to the penalties provided in this Code.

(B) Emergency Orders. Whenever the authority having jurisdiction finds that any building or structure, or portion thereof, is in such a dangerous and unsafe condition as to constitute an imminent hazard to life or limb, the authority having jurisdiction may issue an emergency order. The emergency order may (1) direct that the building or structure, or portion thereof, be restored to a safe condition; (2) require that the building or structure, or portion thereof, be vacated by a date certain to be specified in the order; and (3) in the case of extreme danger may specify immediate vacation of the building or structure and authorize the disconnection of utilities or energy source pursuant to Section 80.10(D). No person shall occupy the building or structure, or portion thereof, after the date on which it is required to be vacated until it is restored to a safe condition as required by the order and this *Code*. It shall be unlawful for any person to fail to comply with an emergency order issued by the authority having jurisdiction.

(1) **Service of the Emergency Order.** The order shall be posted on the premises or personally served on the owner of the building or premises or any person responsible for the condition. The order shall specify a date certain for compliance. Service shall be in the manner set forth in Section 80.13 of this *Code.*

(2) **Effect of the Emergency Order.** No person may occupy a building, structure, or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure, or premises, or

portion thereof, is restored to a safe condition as required by the order and this *Code*. It is a violation for any person to fail to comply with an emergency order issued by the authority having jurisdiction.

(C) Hazard correction order. Whenever the authority having jurisdiction finds that unsafe equipment exists, the authority having jurisdiction may issue a hazard correction order specifying the conditions causing the equipment to be unsafe and directing the owner or other person responsible for the unsafe equipment to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the authority having jurisdiction analyzing the conditions and establishing that the equipment is, in fact safe. The authority having jurisdiction may require that the report or analysis be prepared by a licensed engineer.

(1) Service of hazard correction order. The order shall be served upon the owner, agent, or other responsible person by personal service or regular first-class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first-class mail.

(2) Effect of hazard correction order. It is a violation for any person to fail to comply with a hazard correction order as specified in this subsection.

80.13 Enforcement, Violations, and Penalties.

(A) Violations. It shall be a violation of this *Code* for any person, firm, or corporation to:

(1) erect, construct, enlarge, repair, move, improve, remove, convert, or demolish, equip, occupy, or maintain any building or structure in the City, contrary to or in violation of any of the provisions of this *Code;*

(2) knowingly aid, abet, counsel, encourage, hire, commend, induce, or otherwise procure another to violate or fail to comply with any of the provisions of this *Code;*

(3) use any materials or to install any device, appliance, or equipment which does not comply with applicable standards of this *Code* or which has not been approved by the authority having jurisdiction;

(4) violate or fail to comply with any final order issued by the building official pursuant to the provisions of this *Code* or with any requirements of this *Code;*

(5) remove, mutilate, destroy, or conceal any notice or order issued or posted by the building official pursuant to the provisions of this *Code*, or any notice or order issued or posted by the building official in response to a natural disaster or other emergency; or

(6) conduct work under permit without requesting inspections required by this *Code.*

(B) Notice of Violation. If, after investigation, the authority having jurisdiction determines that standards or requirements of this *Code* have been violated or that orders or requirements have not been complied with, the authority having jurisdiction may serve a notice of violation upon the owner, agent, or other person responsible for the action or condition. The notice of violation shall state the standards or requirements violated, what corrective action, if any, is necessary to comply with the standards or requirements, and a date certain for compliance.

(1) Serving the Notice of Violation. The notice shall be served upon the owner, agent, or other responsible person by personal service or first-class mail addressed to the last known address of such person. If no address is available after reasonable inquiry, the notice may be posted at a conspicuous place on the property. The notice may also be posted even if served by personal service or first-class mail. The notice of violation shall be considered a final order of the authority having jurisdiction if no request for review before the authority having jurisdiction is made pursuant to Section 80.13(B)(2). Nothing in this section

limits or precludes any action or proceeding to enforce this Article, and nothing obligates or requires the authority having jurisdiction to issue a notice of violation prior to the imposition of civil or criminal penalties.

(2) Review of Notice of Violation by the Authority Having Jurisdiction.

(a) Any person affected by a notice of violation issued pursuant to Section 80.13(B) may obtain a review of the notice by making a request in writing within 10 days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or City holiday, the period runs until 5:00 p.m. of the next business day.

The review shall occur not less than 10 nor more than 20 days after the request is received by the authority having jurisdiction unless otherwise agreed by the person requesting the review.

Any person affected by the notice of violation may submit additional information to the authority having jurisdiction within ten days after the request for review is filed, unless the authority having jurisdiction and the person requesting the review agree to a different time period for documents to be submitted.

(b) The review shall be made by a representative of the authority having jurisdiction who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and a site visit.

After the review, the authority having jurisdiction shall:

(1) Sustain the notice; or

(2) Withdraw the notice; or

(3) Amend the notice; or

(4) Continue the review to a date certain.

(c) The authority having jurisdiction shall issue an order containing the decision within 15 days of the date that the review is completed and shall mail or cause the order to be mailed by regular first-class mail to the persons requesting the review and the persons named on the notice of violation, addressed to their last known addresses. This decision is the final order of the authority having jurisdiction.

(C) Stop Work Orders. Whenever any installation, alteration, repair, or removal of electrical work is being done contrary to the provisions of this *Code*, or in the event of dangerous or unsafe conditions related to electrical work, the authority having jurisdiction may issue a stop work order describing the violation or unsafe condition at the site. No electrical work may proceed until the described violation or condition is corrected and approved by the authority having jurisdiction.

(1) Service of Stop Work Order. The authority having jurisdiction may serve the stop work order by posting it in a conspicuous place at the site, if posting is physically possible. If posting is not physically possible the stop work order may be served by personal service or by first class mail to the last known address of the property owner, the person doing or causing the work to be done, and the holder of a permit if work is being stopped on a permit. For the purpose of this section, service is complete at the time of posting or of personal service, or if mailed, 3 days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday, or City holiday, the period runs until 5:00 p.m. on the next business day.

(2) Effective Date of Stop Work Order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the persons identified in Section 80.11(B)(1) is served.

(3) Review by the Authority Having Jurisdiction for Stop Work Orders

(a) Any person aggrieved by a stop work order may obtain a review of the order by delivering to the authority having jurisdiction a request in writing within 2 business days of the date of service of the stop work order. The review shall occur within 2 business days after receipt by the authority having jurisdiction of the request for review unless the requestor agrees to a longer time. Any person aggrieved by or interested in the stop work order may submit additional information to the authority having jurisdiction for consideration as part of the review at any time prior to the review.

(b) The review will be made by a representative of the authority having jurisdiction who will review all additional information received and may also request a site visit. After the review, the authority having jurisdiction may:

(1) Sustain the stop work order;

(2) Withdraw the stop work order;

(3) Modify the stop work order; or

(4) Continue the review to a date certain for receipt of additional information.

(c) The authority having jurisdiction shall issue an order containing the decision within 2 business days after the review and shall cause the order to be sent by first class mail to the person or persons requesting the review, any person on whom the stop work order was served, and any other person who requested a copy before issuance of the order, addressed to their last known address.

(D) Civil Actions and Penalties.

(1) Civil Penalties. Any person found violating or failing to comply with the provisions of this *Code* shall be subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved. In cases where the authority having jurisdiction has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

(2) Enforcement in Municipal Court. Civil actions to enforce this chapter shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of a notice of violation or of an order following a review by the authority having jurisdiction is not itself evidence that a violation exists.

(3) Judicial Review. Because civil actions to enforce this *Code* must be brought exclusively in Seattle Municipal Court pursuant to Subsection 80.13(D)(2), orders of the authority having jurisdiction, including notices of violation issued under this chapter, are not subject to judicial review pursuant to chapter 36.70C RCW.

(4) Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by Title 22 and this *Code* may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

(E) Alternative Criminal Penalty. Anyone violating or failing to comply with any notice of violation or order issued by the authority having jurisdiction pursuant to this *Code* or who removes, mutilates, destroys, or conceals a notice issued or posted by the authority having jurisdiction shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

(F) Additional Relief. The authority having jurisdiction may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

80.14 Recording of Notices.
The authority having jurisdiction may record a copy of any order or notice with the Department of Records and Elections of King County.

The authority having jurisdiction may record with the Department of Records and Elections of King County a notice that a permit has expired without a final inspection after reasonable efforts have been made to obtain a final inspection.

80.15 Rules of the Authority Having Jurisdiction.
(A) Authority. The authority having jurisdiction has authority to issue interpretations of this *Code* and to adopt and enforce rules and regulations supplemental to this *Code* as may be deemed necessary in order to clarify the application of the provisions of this *Code*. Such interpretations, rules, and regulations shall be in conformity with the intent and purpose of this *Code.*

(B) Procedure for Adoption of Rules. The authority having jurisdiction shall promulgate, adopt, and issue rules according to the procedures as specified in the *Administrative Code,* Chapter 3.02 of the *Seattle Municipal Code*.

80.16 Construction Codes Advisory Board.
An Electrical Code Committee of the Construction Codes Advisory Board, as established in Section 105 of the Seattle Building Code, may examine proposed new editions of and amendments to this *Code* and any proposed administrative rules promulgated to enforce this *Code*. The Electrical Code Committee may make recommendations to the authority having jurisdiction and to the City Council relating to this *Code* and administrative rules. The committee may be called on an as-needed basis for the Construction Codes Advisory Board.

80.17 Administrative Review.
Prior to issuance of the electrical permit, applicants may request administrative review by the authority having jurisdiction of decisions or actions pertaining to the application and interpretation of this Code by the Construction Codes Advisory Board according to International Building Code Section 103.11, except for emergency orders, hazard correction orders, stop work orders, notices of violations, and revocations of permits. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review is advisory only; the final decision is made by the authority having jurisdiction.

III. Permits and Inspections
80.50 Permit Application.
(A) Permit Required. It shall be unlawful to install, alter, repair, replace, modify, extend, or connect any electrical equipment, or allow the same to be done, without first obtaining a permit for the work from the authority having jurisdiction, except as allowed in subsections (B) and (C) of this Section. A separate electrical permit is required for each separate building or structure.

Informational Note: See the "Smoke and Fire Protection Features" section in the *Seattle Building Code* for required protection methods when electrical work penetrates fire-resistance rated building elements.

(B) Like-in-Kind Replacement. An electrical permit shall not be required for the like-in-kind replacement of the following electrical equipment:

(1) no more than 5 single-family residential luminaires, snap switches, dimmers, receptacles, lamps, or luminaire ballasts with an identical ballast;

(2) a single set of fuses, a single battery smaller than 150 amp hour, or single lead acid batteries;

(3) circuit breakers, contactors, relays, timers, starters, circuit boards, thermostats, or similar control components. For the purpose of this section, "circuit breaker" means a circuit breaker that is used to provide overcurrent protection only for a branch circuit, as defined in NEC 100;

(4) household appliances when the equipment is reconnected to a circuit that was lawfully installed and approved, and no alteration of the circuit is necessary.

For the purpose of this section, a household appliance is defined as: Utilization equipment installed in a dwelling unit that is built in standardized sizes or types and is installed or connected as a unit to perform one or more household functions such as food preparation, cooking, and cleaning. Household appliances include but are not limited to appliances typically installed in a dwelling unit kitchen; clothes washing, drying, and water heating appliances; portable room air conditioning units and portable heaters; etc.

Fixed electric space-heating equipment covered in NEC 424 (furnaces, baseboard and wall heaters, electric heat cable, etc.) and fixed air-conditioning/heat pump equipment (NEC 440) are not household appliances.

Household appliance does not mean any utilization equipment that:
(a) Supplies electrical power, other than Class 2, to other utilization equipment; or
(b) Receives electrical power, other than Class 2, through other utilization equipment.

(5) component(s) of electrical signs, outline lighting, or skeleton neon tubing when replaced on-site by an appropriately licensed electrical contractor and when the sign, outline lighting or skeleton neon tubing system is not modified;

(6) one 10-horsepower or smaller motor;

(7) electrical equipment repaired or installed in connection with an elevator, dumbwaiter, or similar conveyance when the equipment work is covered under an issued elevator permit; and

(8) acid batteries supporting a listed UPS system when replaced by a factory authorized technician.

(C) Work Exempt from Permitting Requirements. An electrical permit shall not be required for the following electrical equipment:
(1) induction detection loops used to control gate access devices;

(2) induction detection loop or similar circuits for traffic management systems will be accepted by the authority having jurisdiction without inspection;

(3) embedded premanufactured heat mats placed in tile grout where the mat is listed by an approved testing laboratory and comes from the manufacturer with preconnected lead-in conductors. All listing marks and lead- in conductor labels must be left intact and visible for evaluation and inspection by the installing electrician and the electrical inspector; and

(4) wiring for communication systems and installation of optical fiber cables, as set forth in *NEC* Chapter 8 and Article 770 in one- and two-family dwellings.

Exemption from the permit requirements of this *Code* shall not be deemed to grant authorization for work done in any manner that violates the provisions of this *Code* or any other laws or ordinances of the City. All work shall comply with this *Code,* even where no permit is required.

(D) Flood Hazard Areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard, as identified in the report entitled "Flood Insurance Study for King County, Washington and Incorporated Areas" and the accompanying Flood Insurance Rate Maps filed in C.F. 296948, is subject to additional standards and requirements, including floodplain development approval or a Floodplain Development License as set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance, and Chapter 16 of the Seattle Building Code.

80.51 Application for Permit.
(A) Application. To obtain a permit, the applicant shall first file an application in a format determined by the authority having jurisdiction. Every application shall:
(1) Identify and describe the work to be covered by the permit for which application is made;

(2) Describe the land on which the proposed work is to be done by legal description, property address, or similar description that will readily identify and definitively locate the proposed building or work;

(3) Provide the business name, address, phone number for the project contact and contractor and the contractor's current contractor registration number with state license number of the licensed contractor, if a contractor has been selected;

(4) Be accompanied by construction documents, including plans, drawings, diagrams, computations and specifications, equipment schedules, and other data as required in Sections 80.54(B) and (C) when required by the authority having jurisdiction;

(5) State the valuation of the electrical work to be done. The valuation of the electrical work is the estimated current value of all labor and material, whether paid for or not, for which the permit is sought;

(6) Be electronically submitted by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority;

(7) Give such other data and information as may be required by the authority having jurisdiction;

(8) State the name of the owner and the name, address, and phone number of a contact person;

(9) Substantially conform with applicable law in effect on the date described in Section R101.3, as modified by any exception; and

(10) Include documentation of compliance with the *Seattle Energy Code*.

The authority having jurisdiction may refuse to issue or may revoke a permit if any statement in the permit application is found to be untrue.

(B) Construction Documents for Plan Review.
(1) **General.** In addition to the requirements of Section 80.51(A), construction documents, including plans and specifications, shall be submitted with each electrical plan review or photovoltaic system permit application and in an electronic format approved by the authority having jurisdiction.

Construction documents for plan review shall be submitted for work that includes the following:
(a) services or feeders of 400 amperes or over;

(b) switches, and circuit breakers, 400 amperes and larger installed in equipment rated 400 amperes or over;

(c) any equipment operating at voltages exceeding 600;

(d) services, feeders, and power supplies for emergency, legally required standby or firepump systems;

(e) proposed alteration or installation, the scope of which covers more than 5,000 square feet;

(f) proposed alteration or installation which cannot be adequately described on the application form;

(g) new or altered electrical installations in educational, institutional, and health or personal care occupancies as required in 296-46B-900(1); (3)(a), (b), (c), (e), & (g); and WAC 269-46B-900 Tables 900-1 and 900-2; and

Exception to (a) through (g): Plan review applications will not be accepted for installations in one- and two-family dwelling structures that can be adequately described on the over-the-counter application form.

(h) photovoltaic and other renewable energy systems;

(i) energy storage system (ESS);

(j) New equipment or systems on a development site with three or more dwelling units or multiple buildings that are not regulated elsewhere in this section.

Construction documents and permit fees for photovoltaic and other renewable energy systems required by 80.51(B)(1)(h) shall be submitted and paid as follows:
(1) systems rated over 26 kW AC output shall submit plans and specifications, including system layout and all system components at the time of application (value based fee);
(2) systems rated 12 kW-26kW AC output shall submit plans and specifications, including system layout and all system components at the time of application (fixed fee);
(3) systems rated below 12 kW AC output shall upload supporting documents and one-line diagram for system installation to OTC permit.

(2) Fire Department Review. Electronic plans and specifications for fire alarm systems and energy storage systems (ESS) shall be submitted to SDCI. SDCI shall provide electronic plans to the Seattle Fire Department for review. See Seattle Fire Code Section 907 for required submittal information.

(3) Clarity of Plans. Plans shall be drawn to a clearly indicated and commonly accepted scale. The plans shall be of sufficient quality to be easily read.
Informational Note: See Seattle TIP 106

Plans shall indicate the nature and extent of the work proposed and shall show in detail that it will conform to the provisions of this *Code.* All new and revised electrical work shall be readily distinguishable from other electrical work. Applicants shall not use a red color to create notes, text, annotations, and "redlines" within electronic plans. The use of a red color on submitted plan sets will be reserved for the exclusive use of SDCI plans examiners. If plans are incomplete, unintelligible, indefinite, or poorly organized, the authority having jurisdiction may require that the plans be prepared by a licensed electrical engineer, or may reject or refuse to examine such plans, even though a plan examination fee has been paid in accordance with *Seattle Municipal Code*, Title 22, Subtitle IX, Permit Fees.

(4) Information Required on Plans. Information on plans and specifications shall include the following:
(a) the type of occupancy and a complete scope of work;

(b) a complete riser and a one-line diagram to include:
(1) approved service point location, service connection, metering, and grounding,

(2) feeder connections and if utilized, their equipment grounding conductors,

(3) grounding of separately derived systems,

(4) grounding electrode system and conductor size for service, transformers, and generators including main and system bonding jumpers,

(5) equipment specifications and designations, including voltage, ampacity, disconnecting means and short-circuit current rating,

(6) ground-fault equipment protection, when required,

(7) transformer over-current protective device size(s),

(8) transformer primary and secondary voltage, and kilovolt-amperes (KVA) rating, and

(9) smoke control fans

(c) clear identification of all circuitry, including but not limited to: circuit numbers, wire sizes, insulation types, conduit sizes and types;

(d) elevators used as an accessible means of egress element and clearly identified as such;

(e) a complete set of switchboard and panel schedules. These shall include all load calculations and demand factors used for computation per Article 220;

(f) a complete project load summary to include existing loads as computed in accordance with *NEC* Article 220, and all added loads. Electrical calculations and lighting summaries may be submitted on separate computation sheets;

(g) fault current calculations and the listed interrupting rating of all feeder and service equipment;

(h) a key to all symbols used;

(i) a luminaire schedule showing all pertinent information and include the *Seattle Energy Code* lighting power allowance form; and

(j) any other information as may be required by the plans examiner.

(C) Incomplete Submittals. Plans shall be submitted in a manner that is organized to facilitate plan review. Plan sets not having the information and specifications required by 80.51(B) or not clearly organized are deemed to be incomplete submittals. Review time will be charged at the hourly rate established by the Seattle Fee Subtitle until a complete submittal is received.

80.52 Application Review and Permit Issuance.

(A) Issuance. The application and construction documents shall be reviewed by the authority having jurisdiction. The construction documents may be reviewed by other departments of the City to ascertain compliance with the laws and ordinances under their jurisdiction.

(1) Issuance of Permit. A permit shall be issued to the applicant who becomes the permit holder if the authority having jurisdiction finds the following:

1. The work as described in an application for permit and the construction documents conform to the requirements of this *Code* and other applicable laws and ordinances; and
2. The fees specified in *Seattle Municipal Code,* Title 22, Subtitle IX, Permit Fees, have been paid.

Exception No. 1: The authority having jurisdiction may issue a permit for the installation of part of the electrical system of a building or structure before complete plans for the whole building or structure have been submitted or approved, provided adequate information and detailed statements have been filed complying with all pertinent requirements of this Code. Holders of such permits may proceed at their own risk without assurance that the permit for the entire building or structure will be granted.

Exception No. 2: A permit may be issued for work to commence prior to the approval of plans, if such approval is delayed beyond 10 working days after the plans have been submitted for examination. The holders of such

permits may proceed at their own risk, with the understanding that any work undertaken prior to approval of plans shall be done in accordance with the provisions of this Code and in accordance with the plans as subsequently approved.

Informational Note: Exception No. 2 refers to what is commonly called, by the Department of Construction and Inspections, a "Get Started Permit."

(2) Compliance with Approved Construction Documents. When issuing a permit, the authority having jurisdiction shall endorse the permit in writing and endorse in writing or stamp the plans "APPROVED." Approved plans and permits shall not be changed, modified, or altered without authorization from the authority having jurisdiction, and all work shall be done in accordance with the approved plans, except as the authority having jurisdiction may require during field inspection to correct errors or omissions.

(3) Revisions to the Permit. When changes to the approved work are proposed during construction, approval of the authority having jurisdiction shall be obtained prior to making the changes. The authority having jurisdiction may approve minor changes to the plans for work that does not reduce the fire and life safety of the structure. The authority having jurisdiction shall determine if it is necessary to revise the approved construction documents to describe the changes.

If revised plans are required, changes shall be submitted to and approved by the authority having jurisdiction, accompanied by fees specified in the *Seattle Municipal Code,* Title 22, Subtitle IX, Permit Fees prior to occupancy. All substitutions and changes shall conform to the requirements of this *Code* and other pertinent laws and ordinances.

(4) Requirement for License. No electrical permit shall be issued to an applicant who is engaging in, conducting, or carrying on the business of installing wires or equipment to convey electric current or of installing apparatus to be operated by electric current unless the applicant possesses a valid State of Washington license as required by RCW 19.28. The licensed installer responsible for the work shall be identified on the electrical permit.

Exception: Persons not possessing a license may obtain an electrical permit in order to do electrical work at a residence, farm, place of business, or other property that they own as described in RCW 19.28.261.

(5) Cancellation of Permit Application. Applications may be cancelled if no permit is issued by the earlier of the following:

(1) Twelve months following the date of application; or

(2) Sixty days from the date of written notice that the permit is ready to issue.

The authority having jurisdiction shall notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted in order to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

Exception: Notwithstanding other provisions of this Code, applications may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes, or other causes related to the application that are beyond the applicant's control.

(6) Extensions Prior to Permit Issuance. At the discretion of the authority having jurisdiction, applications for projects that require more than 12 months to review and approve may be extended for a period that provides reasonable time to complete the review and approval, but in no case longer than 24 months from the date of the original application. No application may be extended more than once. After the application is cancelled, the applicant shall submit a new application and pay a new fee to restart the permit process.

Exception: Notwithstanding other provisions of this Code, applications may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes, or other causes related to the application that are beyond the applicant's control, or while the applicant is making progress toward issuance of a master use permit.

(B) Retention of Plans and Permits. The electronically approved construction documents shall be retained by the authority having jurisdiction. The permit holder shall make a printed copy of the approved construction drawings available on the job site for use by inspectors while work is authorized to occur. Construction drawings provided for

the use of inspectors on the job site shall be in color and shall have minimum dimensions of 11" x 17" for photovoltaic installations and 24" x 30" or larger as required to be readable for all other installations. A copy of the electrical permit shall be posted in a conspicuous location on the premises at all times during the course of the installation or work.

(C) Validity. The issuance of a permit or approval of construction documents shall:

(1) not be construed to be a permit for, or an approval of, any violation of any of the provisions of this *Code* or other pertinent laws or ordinances;

(2) not prevent the authority having jurisdiction from later requiring the correction of errors in the plans or from preventing building operations being carried on thereunder when in violation of this *Code* or of other pertinent laws and ordinances of the City;

(3) not prevent the authority having jurisdiction from requiring correction of conditions found to be in violation of this *Code* or any other ordinance of the City; and

(4) not be construed to extend or otherwise affect any period of time for compliance specified in any notice or order issued by the authority having jurisdiction or other administrative authority requiring the correction of any such conditions.

(D) Expiration and Renewal of Issued Permits.

(1) Expiration of Permits. Authority to do the work authorized by a permit expires 12 months from the date of issuance.

Exception No. 1: Initial permits for major construction projects that require more than 1 year to complete, according to a construction schedule submitted by the applicant, may be issued for a period that provides reasonable time to complete the work but in no case longer than 3 years.

Exception No. 2: Permits that expire in less than 1 year may be issued where the authority having jurisdiction determines a shorter period is appropriate based on the scope of work or otherwise limited by this Code.

Informational Note: See Article 590 Temporary Installations.

(2) Renewal. Permits may be renewed and renewed permits may be further renewed by the authority having jurisdiction provided the following conditions are met:

(1) Application for renewal shall be made within the 30-day period immediately preceding the date of expiration of the permit;

(2) The work authorized by the permit has been started and is progressing at a rate approved by the authority having jurisdiction;

(3) If an application for renewal is made either more than one year after the effective date of a new or revised edition of the Electrical Code, the permit shall not be renewed unless:

(a) The authority having jurisdiction determines that the permit complies, or is modified to comply, with the Electrical code or codes in effect on the date of application renewal;

(b) The work authorized by the permit is substantially underway and progressing at a rate approved by the authority having jurisdiction. “Substantially underway” means that normally required inspections have been approved or work is being completed and inspected on a continuing basis; or

(c) Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes, or other extraordinary circumstances related to the work authorized by the permit, beyond the permit holder’s control; and

(d) If the project has had an associated discretionary Land Use review, and the land use approval has not expired.

(3) Re-establishment of Expired Permits. A new permit shall be required to complete work where a permit expired and work remains to be completed.

Exception: A permit which has been expired for less than one year may be reestablished upon approval of the authority having jurisdiction provided it complies with Items (1) and (2) of Section 80.52(D)(2) above.

(E) Revocation of Electrical Permits. Whenever the authority having jurisdiction determines there are grounds for revoking a permit issued under the provisions of this *Code,* the authority having jurisdiction may issue a notice of revocation.

(1) Standards for Revocation. A permit may be revoked if:

(a) This *Code* or the permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation;

(b) The permit was obtained with false or misleading information; or

(c) The permit was issued in violation of any ordinance or regulation or provision of this *Code*.

(d) The permit was issued in error.

(2) Notice of Revocation. Whenever the authority having jurisdiction determines there are grounds for revoking a permit, a notice of revocation may be issued. The notice of revocation shall identify the reason for the proposed revocation, including the violations, the conditions violated, and any alleged false or misleading information provided.

(a) Serving Notice of Revocation. The notice of revocation shall be served upon the owner of the property, the owner's authorized agent, or the person designated by the owner or agent to do the work authorized by a permit. The notice of revocation shall be served by personal service or first-class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first-class mail.

For purposes of this Section, service is complete at the time of personal service, or if mailed, 3 days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday, or City holiday, the period runs until 5 p.m. on the next business day.

(b) Effective Date of Revocation. The authority having jurisdiction shall identify in the notice of revocation a date certain on which the revocation will take effect unless review before the authority having jurisdiction is requested and pursued pursuant to Section 80.52(E)(3).

(3) Review by the Authority Having Jurisdiction for Notice of Revocation.

(a) Requesting a Review. Any person aggrieved by a notice of revocation may obtain a review by making a request in writing to the authority having jurisdiction within 3 business days of the date of service of the notice of revocation.

The review shall occur within 5 business days after receipt by the authority having jurisdiction of the request for review.

(b) Information Reviewed. Any person affected by the notice of revocation may submit additional information to the authority having jurisdiction for consideration as part of the review at any time prior to the review. The review will be made by a representative of the authority having jurisdiction who will review all additional information received and may also request a site visit.

(c) After the Review. After the review, the authority having jurisdiction may:

(1) sustain the notice of revocation and set or modify the date the revocation will take effect; or

(2) withdraw the notice of revocation; or

(3) modify the notice of revocation and set or modify the date the revocation will take effect; or

(4) continue the review to a date certain.

(d) Decision of the Authority Having Jurisdiction. The authority having jurisdiction shall issue an order containing the decision within 10 days after the review and shall cause the same to be sent by first class mail to the person or persons requesting the review, any other person on whom the notice of revocation was served, and any other person who requested a copy before issuance of the order. The order of the authority having jurisdiction is the final order of the City, and the City and all parties shall be bound by the order.

(F) Permit for Temporary Installations. The authority having jurisdiction may issue a nonrenewable permit for temporary electrical installations for use during the construction of buildings or for events such as carnivals, conventions, festivals, fairs, the holding of religious services, and temporary street lighting if life or property will not be jeopardized.

Permission to use a temporary installation shall be granted for no longer than 12 months, except that a permit for a temporary installation to be used for the construction of a building may be issued for the necessary period of construction. When temporary lighting is over the street area or public rights-of-way, proper authority for use of the rights-of-way shall first be obtained from the Seattle Department of Transportation. All temporary installations shall comply with all other requirements of this *Code.*

80.54 Inspections.

(A) General. All construction or work for which a permit is required is subject to inspection by the authority having jurisdiction. In addition to the inspections specified in Article 80, the authority having jurisdiction may make or require any other inspections of any electrical work to ascertain compliance with the provisions of this Code and other laws and ordinances that are enforced by the authority having jurisdiction.

(B) Connection of Electric Installations. It shall be unlawful to connect or to allow the connection of any electrical installations, extensions thereof, or electrical equipment to the electric current until the work is inspected and approved by the authority having jurisdiction.

(C) Inspection Requests. The owner of the property, the owner's authorized agent, or the person designated by the owner or agent to do the work authorized by a permit shall notify the authority having jurisdiction that work is ready for inspection as specified in this section and Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees. Where a permit has been issued to a licensed contractor, it shall be the duty of the contractor to notify the authority having jurisdiction that work requiring inspection is ready for inspection.
The permit holder and the person requesting any inspections required by this Code shall provide access to and means for proper inspection of the work. It shall be the duty of the permit holder to cause the work to be accessible and exposed for inspection purposes until the work receives final approval by the authority having jurisdiction. Neither the authority having jurisdiction nor the City shall be liable for any expense incurred in the required removal or replacement of any material to allow inspection.

(D) Inspection Record. Work requiring an electrical permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position which allows the authority having jurisdiction to conveniently make the required entries thereon regarding inspection of the work. This record shall be maintained in such position by the permit holder or the permit holder's agent until final approval has been granted by the authority having jurisdiction and the serving utility has made the connection to the electric current.

(E) Approvals Required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the approval of the authority having jurisdiction. Approval shall be given only after an inspection has been made of each successive step in the construction as indicated by each of the inspections required in Section 80.54(F) below.
Approval as a result of an inspection is not an approval of any violation of the provisions of this Code or of other pertinent laws and ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this Code or of other pertinent laws and ordinances of the City are not valid.

(F) Required Inspections.

(1) Cover Inspection. The authority having jurisdiction is authorized to conduct cover inspections when the following work has been completed:

(a) All piping, ducts, plumbing, and like installations of other trades which are liable to interfere or run in close proximity to the electrical installation are permanently in place and inspected, but prior to any work to cover or conceal any installation of electrical equipment;

(b) Electrical equipment grounding (boxes, equipment, conductors, and provisions for grounding receptacles, etc.) for all systems shall be completely made-up; and

(c) For conduit systems, after all conduit has been installed and properly secured to the structure.

(d) For PV systems, a cover inspection shall be required for any rooftop equipment before installation to verify suitability. Equipment must be on site at grade level for inspection.

(2) Final Inspection. The authority having jurisdiction is authorized to conduct a final inspection after all wiring has been completed and all permanent fixtures such as switches, outlet receptacles, plates, electric hot-water tanks, lighting fixtures and all other equipment have been properly installed. The permit holder shall call for a final inspection when the work described on the permit has been completed. Failure to obtain a final inspection is a violation of Section 80.13 of this Code.

(G) Other Inspections. In addition to the required inspections specified in Section 80.54(E), the authority having jurisdiction is authorized to conduct or require any other inspections of any construction work to ascertain compliance with the provisions of this Code and other laws enforced by the authority having jurisdiction.

Where work, for which any permit or approval is required, is commenced or performed prior to making formal application and receiving the authority having jurisdiction's permission to proceed, the authority having jurisdiction may make a special investigation inspection before a permit may be issued for the work. Where a special investigation is made, a special investigation fee may be assessed in accordance with Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees.

If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the authority having jurisdiction's permission to proceed, the authority having jurisdiction may make a special investigation inspection before a permit is issued for the work. If a special investigation is made, a special investigation fee may be assessed in accordance with Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees.

(H) Corrections. Inspection corrections shall be completed and scheduled for re-inspection within 14 days of notice or reinspection fees may be applied.

(I) Reinspections. The authority having jurisdiction may reinspect when work is not complete, corrections are not made, approved plans are not readily available to the inspector, access on the date for which inspection is requested is not provided, or work has deviated from approved construction documents.

For the purpose of determining compliance with Section 80.4(D), Maintenance, the authority having jurisdiction or the fire chief may cause any structure to be reinspected.

The authority having jurisdiction may assess a reinspection fee as set forth in Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees for any action listed above for which reinspection may be required.

In instances where reinspection fees have been assessed, no additional inspection of the work shall be performed until the required fees have been paid.

80.55 Fees. A fee for each electrical permit and for other activities related to the enforcement of this Code shall be paid as set forth in the Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees.

NEC 70

National Electrical Code

2023 Edition

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REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION: Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Chapters, annexes, sections, figures, and tables that are new are indicated with an ***N***.

ARTICLE 90
Introduction

Article 90, Introduction, is not adopted.

ARTICLE 100
Definitions

Authority Having Jurisdiction (AHJ). ((~~An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure~~. (CMP-1))) The Department of Construction and Inspections is authorized to administer and enforce this *Code* and shall be known throughout this Code as the *authority having jurisdiction.* The Department of Construction and Inspections is under the administrative and operational control of the Director.

((~~Informational Note: The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.~~))

Basement. The portion of a building that is partly or completely below grade plane. A basement will be considered as a story above grade plane and not a basement where the finished surface of the floor above the basement is either more than six feet above grade plane, more than six feet above the finished ground level for more than 50 percent of the total building perimeter, or more than 12 feet above the finished ground level at any point.

Development Site. A development site is a property boundary that the Seattle Department of Construction and Inspections (SDCI) uses to apply code standards, such as land use, building, and electrical code (at a minimum). A development site can be subdivided into multiple unit lots that allow for separate ownership (see *unit lot subdivision*).

EV-Ready. A minimum 40-ampere dedicated 208 or 240-volt branch circuit (32 amp output) terminated at a junction box or receptacle outlet in close proximity to a parking space.

Identification Plate. A label suitable for the environment that is a printed or etched adhesive label approved by the department or a phenolic or metallic plate or other similar material engraved in block letters at least 1/4 inch high unless specifically required to be larger by this chapter, suitable for the environment and application. The letters and the background must be in contrasting colors. Screws, rivets, or permanent adhesive must be used to affix an identification plate to the equipment or enclosure.

Overhead Electrical Conductors. Any exterior electrical conductor, either bare or insulated, installed above the ground except those conductors enclosed in an approved raceway or enclosure. Overhead Electrical Conductors include but are not limited to overhead power lines, overhead utility conductors, overhead service drops, overhead feeders, etc.

Informational Note: Also see Chapter 31 of the *Seattle Building Code* for regulation of signs and awnings.

Qualified Person. One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. (CMP-1)

Informational Note: RCW 19.28.161 describes training and certification and RCW 19.28.261 describes when the person working with electrical equipment and installations may be exempt from the training and certification. Also see ((~~to~~)) NFPA 70E-2021, Standard for Electrical Safety in the Workplace, for electrical safety training requirements.

((~~**Service Point.** The point of connection between the facilities of the serving utility and the premises wiring. (CMP-10)~~

~~Informational Note: The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.~~))

Service Terminal Box. An approved box to be used exclusively for the connection of the utility distribution system to the consumer's service entrance conductors.

Traffic Management System. A traffic management system provides signalization for controlling vehicular traffic, pedestrian traffic, or rolling stock and may be comprised of the following components:

(1) Traffic illumination systems;

(2) Traffic signal systems;

(3) Traffic monitoring systems;

(4) The electrical service cabinet and all related components and equipment installed on the load side of the service cabinet supplying electrical power to the traffic management system; and

(5) Signalization system(s) necessary for the operation of a light rail system.

Unit Lot Subdivision. A unit lot subdivision divides a development site into separate unit lots that allow for separate ownership.

Unobstructed Egress. Unobstructed egress (as applied to NEC 110.26 (C)(2)(a)) means an egress path that allows a worker to travel to the exit from any other area in the room containing the equipment described in NEC 110.26 (C)(2) without having to pass through that equipment's required working space.

Informational Note: The definition for "egress" found in WAC 296-46B-100 is incorporated herein with edits.

ARTICLE 110
Requirements for Electrical Installations

Part 1 General

110.1 General

(A) Scope. This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment; enclosures intended for personnel entry; and tunnel installations.

(B) Electrical installations serving development sites. The conductors and equipment required or permitted by this code shall only supply one development site and shall not pass through another development site.

Informational Note: See Informative Annex J for information regarding ADA accessibility design.

110.2 Approval. The conductors and equipment required or permitted by this *Code* shall be ((~~acceptable~~)) approved only if ((~~approved~~)) the conductors or equipment meet minimum safety standards by conforming to applicable electrical product standards recognized by the authority having jurisdiction. Suitability of compliance may be demonstrated by listing or labeling from a National Recognized Testing Laboratory (NRTL).

Informational Note: See Sections 80.5, Testing, 90.7, Examination of Equipment for Safety, and 110.3, Examination, Identification, Installation, and Use of Equipment. ((~~See~~)) Also see Article 100 definitions of Approved, Identified, Labeled, and Listed.

110.11 Deteriorating Agents. Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

Informational Note No. 1: See 300.6 for protection against corrosion.

Informational Note No. 2: Some cleaning and lubricating compounds can cause severe deterioration of many plastic materials used for insulating and structural applications in equipment.

Equipment not identified for outdoor use and equipment identified only for indoor use, such as “dry locations,” “indoor use only,” “damp locations,” or enclosure Types 1, 2, 5, 12, 12K, and/or 13, shall be protected against damage from the weather during construction.

Informational Note No. 3: See Table 110.28 for appropriate enclosure-type designations.

Informational Note No. 4: See *NFPA 5000* -2015, *Building Construction and Safety Code*, the *International Building Code (IBC)*, and the *International Residential Code for One- and Two-Family Dwellings (IRC)*, for information for minimum flood provisions.

(A) Exposure not identified for use in the operating environment. Electrical equipment and wiring submerged or exposed to water must comply with the following:

(1) All circuit breakers, fuses, controllers, receptacles, lighting switches or dimmers, electric heaters, and any sealed device or equipment (e.g., relays, contactors, etc.) must be replaced.

(2) All other electrical equipment (e.g., wiring, breaker panelboards, disconnect switches, switchgear, motor control centers, boiler controls, HVAC/R equipment, electric motors, transformers, appliances, water heaters, and similar appliances) must be replaced or reconditioned by the original manufacturer or by its approved representative. See Sections 210.15, 240.62, 240.88, 240.102 and 410.7 for equipment that is not permitted to be reconditioned. See also 110.21(A)(1).

Informational Note: WAC 296-46B-110(011), requirements for electrical equipment and wiring submerged or exposed to water, is incorporated herein.

110.12 Mechanical Execution of Work. Electrical equipment shall be installed in a professional and skillful manner.

Informational Note: See ANSI/NECA 1-2015, *Standard for Good Workmanship in Electrical Construction*, and other ANSI-approved installation standards for information on accepted industry practices.

(A) Unused Openings. Unused openings, other than those intended for the operation of equipment, those intended or mounting purposes, or those permitted as part of the design for listed equipment, shall be closed to afford protection substantially equivalent to the wall of the equipment. Where metallic plugs or plates are used with nonmetallic enclosures, they shall be recessed at least 6 mm (1/4 in.) from the outer surface of the enclosure.

(B) Integrity of Electrical Equipment and Connections. Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating.

Δ (C) Cables and Conductors. Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4 and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties. Where straps or cable ties are installed exposed to sunlight, they shall be listed for exposure to ultraviolet light.

Informational Note No. 1: See NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 4.3.11.2.6.5 and 4.3.11.5.5.6, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 2: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

110.13 Mounting and Cooling of Equipment.

(A) Mounting. Electrical equipment shall be firmly secured to the surface on which it is mounted. Wooden plugs riven into holes in masonry, concrete, plaster, or similar materials shall not be used.

(B) Cooling. Electrical equipment that depends on the natural circulation of air and convection principles for cooling of exposed surfaces shall be installed so that room airflow over such surfaces is not prevented by walls or by adjacent installed equipment. For equipment designed for floor mounting, clearance between top surfaces and adjacent surfaces shall be provided to dissipate rising warm air.

Electrical equipment provided with ventilating openings shall be installed so that walls or other obstructions do not prevent the free circulation of air through the equipment.

(C) Locations.

(1) **Required Egress.** Electrical equipment shall not project beyond the face of the wall or ceiling in halls, corridors, or other locations that would reduce the width or height required by the *Seattle Building Code* for such locations.

Informational Note: See Chapter 10 of the *Seattle Building Code* for prohibitions of electrical equipment within required means of egress system elements.

110.16 Arc-Flash Hazard Warning.

(A) General. Electrical equipment, such as switchboards, switchgear, enclosed panelboards, industrial control panels, meter socket enclosures, and motor control centers, that is in other than dwelling units, and is likely to require examination, adjustment, servicing, or maintenance while energized, shall be field or factory marked to warn qualified persons of potential electric arc flash hazards. The marking shall meet the requirements in 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Δ **(B) Service Equipment and Feeder Supplied Equipment**. In other than dwelling units, in addition to the requirements in 110.16(A), a permanent arc flash label shall be field or factory applied to service equipment and feeder supplied equipment rated 1000 amperes or more. The arc flash label shall be in accordance with applicable industry practice and include the date the label was applied. The label shall meet the requirements of 110.21(B) and contain the following information:

(1) Nominal system voltage
(2) Available fault current at the service and feeder supplied equipment
(3) The clearing time of overcurrent protective devices supplying the equipment based on the available fault current at the equipment.
(4) The date the label was applied

Informational Note No. 1: See ANSI Z535.4-2011 (R2017), *Product Safety Signs and Labels*, for guidelines for the design of safety signs and labels for application to products.

Informational Note No. 2: See NFPA *70E*-2021, *Standard for Electrical Safety in the Workplace*, for applicable industry practices for equipment labeling. This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, minimum required levels of personal protective equipment, and so forth.

110.21 Marking.

(A) Equipment Markings.

Δ **(1) General.** The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be applied or affixed onto all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking shall be of sufficient durability to withstand the environment involved.

(2) Reconditioned Equipment. Reconditioned equipment shall be marked with the following:

(1) Name, trademark, or other descriptive marking of the organization that performed the reconditioning

(2) The date of the reconditioning

(3) The term *reconditioned* or other approved wording or symbol indicating that the equipment has been reconditioned

The original listing mark shall be removed or made permanently illegible. The equipment nameplate shall not be required to be removed or made permanently illegible, only the part of the nameplate that includes the listing mark, if applicable. Approval of the reconditioned equipment shall not be based solely on the equipment's original listing.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

Informational Note No. 1: ANSI-approved standards are available for application of reconditioned and refurbished equipment.

Informational Note No. 2: The term *reconditioned* may be interchangeable with the terms *rebuilt*, *refurbished*, or *remanufactured* even though these are sometimes different processes.

Δ (B) Field-Applied Hazard Markings. Where caution, warning, or danger hazard markings such as labels or signs are required by this *Code*, the markings shall meet the following requirements:

(1) The marking shall be of sufficient durability to withstand the environment involved and warn of the hazards using effective words, colors, symbols, or any combination thereof.

Informational Note No. 1: See ANSI Z535.2-2011 (R2017), *Environmental and Facility Safety Signs*, which describes the design, application, and use of safety signs in facilities and in the environment.

Informational Note No. 2: See ANSI Z535.4-2011 (R2017), *Product Safety Signs and Labels*, which details the design, application, use, and placement of safety signs and labels on a wide variety of products.

(2) The marking shall be permanently affixed to the equipment or wiring method and shall not be handwritten.

Exception to (2): Portions of the markings that are variable, or that could be subject to changes, shall be permitted to be handwritten and shall be legible.

(C) Other Marking or Labeling. Marking or labeling required by this Code shall be of sufficient durability to withstand the environment in which it is used. Unless otherwise required by this Code, both marking and labeling shall have lettering of not less than 6mm (1/4 in.) high and the letters shall be in contrast to the background. Marking or labeling shall be affixed using an identification plate as defined in Article 100.

Exception to (C): Manufacturer's marking shall not be required to have lettering of not less than 6 mm (¼ in.).

Informational Note: The requirements of WAC 296-46B-110 022 are incorporated herein with edits.

110.22 Identification of Disconnecting Means.

(A) General. Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. In other than one- or two-family dwellings, the marking shall include the identification and location of the circuit source that supplies the disconnecting means unless located and arranged so the identification and location of the circuit source is evident. The marking shall be of sufficient durability to withstand the environment involved.

For the purpose of legibly marking a disconnecting means, as required by this section, an identification plate is required unless the disconnect is a circuit breaker or fused switch installed within a panelboard and the circuit breaker or fused switch is identified by a panelboard schedule. In other than one- or two-family dwellings, the identification plate must include the identification designation of the circuit source panelboard that supplies the disconnecting means.

Informational Note: WAC 296-46B-110.022—requirements for identification of disconnecting means is incorporated herein.

(B) Engineered Series Combination Systems. Equipment enclosures for circuit breakers or fuses applied in compliance with series combination ratings selected under engineering supervision in accordance with 240.86(A) shall be legibly marked in the field as directed by the engineer to indicate the equipment has been applied with a series combination rating. The marking shall meet the requirements in 110.21(B) and shall be readily visible and state the following:

CAUTION — ENGINEERED SERIES COMBINATION SYSTEM RATED _____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.

(C) Tested Series Combination Systems. Equipment enclosures for circuit breakers or fuses applied in compliance with the series combination ratings marked on the equipment by the manufacturer in accordance with 240.86(B) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall meet the requirements in 110.21(B) and shall be readily visible and state the following:

CAUTION — SERIES COMBINATION SYSTEM RATED ____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.

Informational Note: See IEEE 3004.5-2014 *Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems*, for further information on series tested systems.

110.26 Spaces About Electrical Equipment. Working space, and access to and egress from working space, shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment. Open equipment doors shall not impede access to and egress from the working space. Access or egress is impeded if one or more simultaneously opened equipment doors restrict working space access to be less than 610 mm (24 in.) wide and 2.0 m (6½ ft) high.

(A) Working Space. Working space for equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), (A)(3), and (A)(4) or as required or permitted elsewhere in this Code.

Informational Note: See NFPA 70E-2021, *Standard for Electrical Safety in the Workplace*, for guidance, such as determining severity of potential exposure, planning safe work practices including establishing an electrically safe work condition, arc flash labeling, and selecting personal protective equipment.

Δ **(1) Depth of Working Space.** The depth of the working space in the direction of live parts shall not be less than that specified in Table 110.26(A)(1) unless the requirements of 110.26(A)(1)(a), (A)(1)(b), or (A)(1)(c) are met. Distances shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed.

(a) *Dead-Front Assemblies*. Working space shall not be required in the back or sides of assemblies, such as dead-front switchboards, switchgear, or motor control centers, where all connections and all renewable or adjustable parts, such as fuses or switches, are accessible from locations other than the back or sides. Where rear access is required to work on nonelectrical parts on the back of enclosed equipment, a minimum horizontal working space of 762 mm (30 in.) shall be provided.

(b) Low Voltage. By special permission, smaller working spaces shall be permitted where all exposed live parts operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc.

(c) *Existing Buildings*. In existing buildings where electrical equipment is being replaced, Condition 2 working clearance shall be permitted between dead-front switchboards, switchgear, enclosed panelboards, or motor control centers located across the aisle from each other where conditions of maintenance and supervision ensure that written procedures have been adopted to prohibit equipment on both sides of the aisle from being open at the same time and qualified persons who are authorized will service the installation.

(2) Width of Working Space. The width of the working space in front of the electrical equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the work space shall permit at least a 90-degree opening of equipment doors or hinged panels.

(3) Height of Working Space. The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6½ ft) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment or support structures, such as concrete pads, associated with the electrical installation and located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

Exception No. 1: On battery systems mounted on open racks, the top clearance shall comply with 480.10(D).

Exception No. 2: In existing dwelling units, service equipment or enclosed panelboards that do not exceed 200 amperes shall be permitted in spaces where the height of the working space is less than 2.0 m (6½ ft).

Exception No. 3: Meters that are installed in meter sockets shall be permitted to extend beyond the other equipment. The meter socket shall be required to follow the rules of this section.

(4) Limited Access. Where equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is required by installation instructions or function to be located in a space with limited access, all of the following shall apply:

(1) Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 559 mm × 559 mm (22 in. × 22 in.), or in a crawl space, there shall be an accessible opening not smaller than 559 mm × 762 mm (22 in. × 30 in.).

(2) The width of the working space shall be the width of the equipment enclosure or a minimum of 762 mm (30 in.), whichever is greater.

(3) All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.

(4) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1) and shall be unobstructed to the floor by fixed cabinets, walls, or partitions. Space reductions in accordance with 110.26(A)(1)(b) shall be permitted. The maximum height of the working space shall be the height necessary to install the equipment in the limited space. A horizontal ceiling structural member or access panel shall be permitted in this space provided the location of weight-bearing structural members does not result in a side reach of more than 150 mm (6 in.) to work within the enclosure.

(5) Separation from High-Voltage Equipment. Where switches, cutouts, or other equipment operating at 1000 volts, nominal, or less are installed in a vault, room, or enclosure where there are exposed live parts or exposed wiring operating over 1000 volts, nominal, the high-voltage equipment shall be effectively separated from the space occupied by the low-voltage equipment by a suitable partition, fence, or screen.

N **(6) Grade, Floor, or Working Platform.** The grade, floor, or platform in the required working space shall be kept clear, and the floor, grade, or platform in the working space shall be as level and flat as practical for the entire required depth and width of the working space.

(B) Clear Spaces. Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.

(C) Entrance to and Egress from Working Space.

(1) Minimum Required. At least one entrance of sufficient area shall be provided to give access to and egress from working space about electrical equipment.

Δ **(2) Large Equipment.** For large equipment that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6½ ft) high at each end of the working space. This requirement shall apply to either of the following conditions:

(1) For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide

(2) For service disconnecting means installed in accordance with 230.71(B) where the combined ampere rating is 1200 amperes or more and where the combined width is over 1.8 m (6 ft)

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

(a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) *Extra Working Space*. Where the depth of the working space is twice that required by 110.26(A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.

Δ **(3) Personnel Doors.** Where equipment rated 800 amperes or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open at least 90 degrees in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.

Informational Note: See UL 305, *Standard For Panic Hardware*, for additional information on panic hardware, and see UL 10C, Standard for Safety for Positive Pressure Fire Tests of Door Assemblies, for additional information.

(D) Illumination. Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, enclosed panelboards, or motor control centers installed indoors. Control by automatic means shall not be permitted to control all illumination within the working space. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.

In residential installations, illumination shall be provided for all working spaces about panelboards that are located outdoors and contain branch circuits.

(E) Dedicated Equipment Space. All service equipment, switchboards, switchgear, panelboards, and motor control centers shall be located in dedicated spaces and protected from damage.

Exception: Control equipment that by its very nature or because of other rules of the Code must be adjacent to or within sight of its operating machinery shall be permitted in those locations.

(1) Indoor. Indoor installations shall comply with 110.26(E)(1)(a) through (E)(1)(d).

(a) *Dedicated Electrical Space.* The space equal to the width and depth of the equipment and extending from the floor to a height of 1.8 m (6 ft) above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone.
Exception: Suspended ceilings with removable panels shall be permitted within the 1.8 m (6 ft) zone.

(b) *Foreign Systems*. The area above the dedicated space required by 110.26(E)(1)(a) shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.

(c) *Sprinkler Protection*. Sprinkler protection shall be permitted for the dedicated space where the piping complies with this section.

(d) *Suspended Ceilings*. A dropped, suspended, or similar ceiling that does not add strength to the building structure shall not be considered a structural ceiling.

(2) Outdoor. Outdoor installations shall comply with 110.26(E)(2)(a) through (E)(2)(c).

(a) *Installation Requirements*. Outdoor electrical equipment shall be the following:

(1) Installed in identified enclosures

(2) Protected from accidental contact by unauthorized personnel or by vehicular traffic

(3) Protected from accidental spillage or leakage from piping systems

(b) *Work Space*. The working clearance space shall include the zone described in 110.26(A). No architectural appurtenance or other equipment shall be located in this zone.

(c) *Dedicated Equipment Space*. The space equal to the width and depth of the equipment, and extending from grade to a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment foreign to the electrical installation shall be located in this zone.

Exception: Structural overhangs or roof extensions shall be permitted in this zone.

(F) Locked Electrical Equipment Rooms or Enclosures. Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.

110.30 General. Conductors and equipment used on circuits over 1000 volts, nominal, shall comply with Part I of this article and with 110.30 through 110.41, which supplement or modify Part I. In no case shall this part apply to equipment on the supply side of the service point.

Each cable operating at over 1,000 Volts and installed on customer-owned systems, must be legibly marked in a permanent manner at each termination point and at each point where the cable is accessible. The required marking must use phase designation, operating voltage, and circuit number, if applicable.

Informational Note: WAC 296-46B-110(030), Requirements for Marking Cable Over 1,000 volts, is incorporated herein.

Part VI Electrified Fences

110.100 Electrified Fences and Similar Devices. It is unlawful to place, or maintain, or allow to be placed, or maintained, any electric fence abutting upon the marginal line of any property in a manner that may be hazardous. Electrified fences, which deliver an intentional electric shock on contact, associated equipment, and similar devices shall be permitted only by special permission from the authority having jurisdiction.

ARTICLE 200
Use and Identification of Grounded Conductors

200.4 Neutral Conductors. Neutral conductors shall be installed in accordance with 200.4(A) and (B).

(A) Installation. Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in this Code.

Informational Note: See 215.4 for information on common neutrals.

(B) Multiple Circuits. Where more than one neutral conductor associated with different circuits is in an enclosure, grounded circuit conductors of each circuit shall be identified or grouped to correspond with the ungrounded circuit conductor(s) by wire markers, cable ties, or similar means in at least one location within the enclosure.

Exception No. 1: The requirement for grouping or identifying shall not apply if the branch-circuit or feeder conductors enter from a cable or a raceway unique to the circuit that makes the grouping obvious.

Exception No. 2: The requirement for grouping or identifying shall not apply where branch-circuit conductors pass through a box or conduit body without a loop as described in 314.16(B)(1) or without a splice or termination.

ARTICLE 210
Branch Circuits

Δ 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

Δ (A) Dwelling Units. All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Exception No. 5 to 210.8 (A) (2) and (5): A receptacle installed in a garage or basement, supplying only a permanently installed fire alarm or burglar alarm system, shall not be required to have ground-fault circuit-interrupter protection. A red receptacle with a red cover plate supplying a fire alarm system is not required to have ground-fault circuit-interrupter protection. The receptacle must be identified for use only with the fire alarm system by an identification plate or engraved cover with letters at least 6.4 mm (1/4 in.) high.

Informational Note: WAC 296-46B-210 008 requirements for dwelling unit GFCI protection are incorporated herein with edits.

Δ **(B) Other Than Dwelling Units.** All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with ((~~sinks and~~)) permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor

program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

(C) Crawl Space Lighting Outlets. GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

Δ **(D) Specific Appliances.** GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(E) Equipment Requiring Servicing. GFCI protection shall be provided for the receptacles required by 210.63.

Δ **(F) Outdoor Outlets.** For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

210.11 Branch Circuits Required. Branch circuits for lighting and for appliances, including motor-operated appliances, shall be provided to supply the loads calculated in accordance with 220.10. In addition, branch circuits shall be provided for specific loads not covered by 220.10 where required elsewhere in this Code and for dwelling unit loads as specified in 210.11(C).

(A) Number of Branch Circuits. The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served. In no case shall the load on any circuit exceed the maximum specified by 220.11.

(B) Load Evenly Proportioned Among Branch Circuits. Where the load is calculated on the basis of volt-amperes per square meter or per square foot, the wiring system up to and including the branch-circuit panelboard(s) shall be provided to serve not less than the calculated load. This load shall be evenly proportioned among multioutlet branch circuits within the panelboard(s). Branch-circuit overcurrent devices and circuits shall be required to be installed only to serve the connected load.

(C) Dwelling Units.

(1) Small-Appliance Branch Circuits. In addition to the number of branch circuits required by other parts of this section, two or more 20-ampere small-appliance branch circuits shall be provided for all receptacle outlets specified by 210.52(B).

(2) Laundry Branch Circuits. In addition to the number of branch circuits required by other parts of this section, at least one additional 20-ampere branch circuit shall be provided to supply the laundry receptacle outlet(s) required by 210.52(F). This circuit shall have no other outlets.

(3) Bathroom Branch Circuits. In addition to the number of branch circuits required by other parts of this section, one or more 120-volt, 20-ampere branch circuit shall be provided to supply bathroom(s) receptacle outlet(s) required by 210.52(D) and any countertop and similar work surface receptacle outlets. Such circuits shall have no other outlets.

Exception: Where the 20-ampere circuit supplies a single bathroom, outlets for other equipment within the same bathroom shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

Δ **(4) Garage Branch Circuits.** In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

(5) Other Required Branch Circuits. A raceway system or one dedicated 15-ampere minimum, 120 volt circuit must be taken to all unfinished space areas adaptable to future dwelling unit living areas that are not readily accessible to the service or branch circuit panelboard. One circuit or raceway is required for each 480

square feet or less of unfinished space area. If the total adjacent unfinished space area is less than 480 square feet, the circuit can be an extension of an existing circuit. The circuits must terminate in a suitable box(es). The box must contain an identification of the intended purpose of the circuit(s). The branch circuit panelboard must have adequate space and capacity for the intended load(s).

Informational Note: The requirements of WAC-46B-210 011 are incorporated herein.

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)(1) through (A)(6). The AFCI shall be listed and installed in a readily accessible location.

Δ **(A) Means of Protection.** AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(4) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

d. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(5) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, Standard for Arc-Fault Circuit-Interrupters, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters, for information on system combination AFCIs.

N **(B) Dwelling Units.** All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See NFPA 72-2022, National Fire Alarm and Signaling Code, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units, Boarding Houses, and Congregate Living Facilities. All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies. All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

Δ **(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.** If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Δ **210.13 Ground-Fault Protection of Equipment.** Each branch-circuit disconnecting means rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 1000 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with 230.95.

Equipment ground fault protection systems required by the NEC must be tested prior to being placed into service to verify proper installation and operation of the system as determined by the manufacturer's published instructions. A firm having qualified personnel and proper equipment must perform the tests required. A copy of the manufacturer's performance testing instructions and a written performance acceptance test record signed by the person performing the test must be available at the time of inspection. The performance acceptance test record must include test details including, but not limited to, all trip settings and measurements taken during the test.

Informational Note 1: See 517.17 for requirements on buildings that contain health care occupancies.

Informational Note 2: The requirements of *WAC 296-46B-210 013* are incorporated herein

Exception No. 1: This section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

Exception No. 2: This section shall not apply if ground-fault protection of equipment is provided on the supply side of the branch circuit and on the load side of any transformer supplying the branch circuit.

210.25 Branch Circuits in Buildings and Development Sites with More Than One Occupancy.

(A) Dwelling Unit Branch Circuits. Branch circuits in each dwelling unit shall supply only loads within that dwelling unit or loads associated only with that dwelling unit.

(B) Common Area Branch Circuits. Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of a two-family dwelling, a multifamily dwelling, multi-occupancy building, or development site with more than one dwelling unit, shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

Exception to B: lighting for common exterior areas not exceeding 50 watts and controlled by a photocell and occupancy sensor.

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

(C) Shared Sump Pump, Septic or Water Well. Branch circuits supplying loads for sump pump, septic or water well systems that are shared by no more than two dwelling units, not including accessory dwelling units, may be supplied from either of the two dwelling units if approved by the authority having jurisdiction and local health department.

Informational Note: WAC 296-46B-210.25, requirements for common area branch circuits for shared septic or water well systems, is incorporated herein with edits

210.52 Dwelling Unit Receptacle Outlets. This section provides requirements for 125-volt, 15- and 20-ampere receptacle outlets. The receptacles required by this section shall be in addition to any receptacle that is as follows:

(1) Part of a luminaire or appliance, or

(2) Controlled by a listed wall-mounted control device in accordance with 210.70(A)(1), Exception No. 1, or

(3) Located within cabinets or cupboards, or

(4) Located more than 1.7 m (5½ ft) above the floor

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlets or outlets provided as a separate assembly by the manufacturer shall be permitted as the required outlet or outlets for the wall space utilized by such permanently installed heaters. Such receptacle outlets shall not be connected to the heater circuits.

Informational Note: Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

A dwelling unit, required by Chapter 11 of the Seattle Building Code to be an Accessible Unit, shall comply with the clearance and reach requirements contained in Seattle Building Code and as shown in Informative Annex J of the 2023 National Electric Code.

(A) General Provisions. In every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(4).

(1) Spacing. Receptacles shall be installed such that no point measured horizontally along the floor line of any wall space is more than 1.8 m (6 ft) from a receptacle outlet.

(2) Wall Space. As used in this section, a wall space shall include the following:

(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and fixed cabinets ((~~that do not have countertops or similar work surfaces~~))or bookcases that extend from the floor to a level at least 1.7 m (5 ft 6 inches) above the floor, and similar openings. Any outlet eliminated by window seating, bookcases, cabinets, or other permanent part of the dwelling configuration or finish must be installed elsewhere within the room

(2) The space occupied by fixed panels in walls, excluding sliding panels

(3) The space afforded by fixed room dividers, such as freestanding bar-type counters or railings

Informational Note: WAC 296-46B-210.052(A)(2)(7) explaining similar openings is incorporated herein with edits.

(3) Floor Receptacles. Receptacle outlets in or on floors shall not be counted as part of the required number of receptacle outlets unless located within 450 mm (18 in.) of the wall.

(4) Countertop and Similar Work Surface Receptacle Outlets. Receptacles installed for countertop and similar work surfaces as specified in 210.52(C) shall not be considered as the receptacle outlets required by 210.52(A).

(B) Small Appliances.

Δ **(1) Receptacle Outlets Served.** In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Exception No. 1: In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose 15- or 20-ampere branch circuit shall be permitted in accordance with 210.70(A)(1), Exception No. 1.

Exception No. 2: In addition to the required receptacles specified by 210.52, a receptacle outlet to serve a specific appliance shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

(2) No Other Outlets. The two or more small-appliance branch circuits specified in 210.52(B)(1) shall have no other outlets.

Exception No. 1: A receptacle installed solely for the electrical supply to and support of an electric clock in any of the rooms specified in 210.52(B)(1) shall be permitted to be served by a small-appliance branch circuit.

Exception No. 2: Receptacles installed to provide power for supplemental equipment and lighting on gas-fired ranges, ovens, or counter-mounted cooking units shall be permitted to be served by a small-appliance branch circuit.

(3) Kitchen Receptacle Requirements. Receptacles installed in a kitchen to serve countertop surfaces shall be supplied by not fewer than two small-appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

(C) Countertops and Work Surfaces. In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

(1) Wall Spaces. Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Δ ***N*** **(2) Island and Peninsular Countertops and Work Surfaces.** Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, no future provisions to do so are required. ((~~provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~))

Informational Note: The exception of WAC 296-46b-210 052 (C)(2)(8) is incorporated herein.

Δ **(3) Receptacle Outlet Location.** Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, Standard on Accessible and Usable Buildings and Facilities, for additional information.

(D) Bathrooms. At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each sink. The receptacle outlet shall be located on a wall or partition that is adjacent to the sink or sink countertop, located on the countertop, or installed on the side or face of the sink cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the sink or sink countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements on installation of receptacles in countertops.

Δ **(E) Outdoor Outlets.** Outdoor receptacle outlets shall be installed in accordance with 210.52(E)(1) through (E)(3).

(1) One-Family and Two-Family Dwellings. For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed at the front and back of the dwelling.

(2) Multifamily Dwellings. For each dwelling unit of a multifamily dwelling where the dwelling unit is located at grade level and provided with individual exterior entrance/egress, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed.

(3) Balconies, Decks, and Porches. Balconies, decks, and porches that are within 102 mm (4 in.) horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch walking surface.

(F) Laundry Areas. In dwelling units, at least one receptacle outlet shall be installed in areas designated for the installation of laundry equipment.

Exception No. 1: A receptacle for laundry equipment shall not be required in a dwelling unit of a multifamily building where laundry facilities are provided on the premises for use by all building occupants.

Exception No. 2: A receptacle for laundry equipment shall not be required in other than one-family dwellings where laundry facilities are not to be installed or permitted.

(G) Basements, Garages, and Accessory Buildings. For one- and two-family dwellings, and multifamily dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G)(1) through (G)(3). These receptacles shall be in addition to receptacles required for specific equipment. Receptacles supplying only a permanently installed premises security system shall not be considered as meeting these requirements.

(1) Garages. In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5½ ft) above the floor.

Exception: Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.

(2) Accessory Buildings. In each accessory building with electric power.

(3) Basements. In each separate unfinished portion of a basement.

(H) Hallways. In dwelling units, hallways of 3.0 m (10 ft) or more in length shall have at least one receptacle outlet.

As used in this subsection, the hallway length shall be considered the length along the centerline of the hallway without passing through a doorway.

(I) Foyers. Foyers that are not part of a hallway in accordance with 210.52(H) and that have an area that is greater than 5.6 m2 (60 ft2) shall have a receptacle(s) located in each wall space 900 mm (3 ft) or more in width. Doorways, door-side windows that extend to the floor, and similar openings shall not be considered wall space.

210.65 Meeting Rooms.

(A) General. Each meeting room of not more than 93 m2 (1000 ft2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.65(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

(B) Receptacle Outlets Required. The total number of receptacle outlets, including floor outlets and receptacle outlets in fixed furniture, shall not be less than as determined in 210.65(B)(1) and (B)(2).

(1) Receptacle Outlets in Fixed Walls. The required number of receptacle outlets shall be determined in accordance with 210.52(A)(1) through (A)(4). These receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

Δ **(2) Floor Outlets.** A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any direction and that has a floor area of at least 20 m2 (215 ft2) shall have at least one floor receptacle outlet, or at least one floor outlet to serve a receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m2 (215 ft2) or fraction thereof.

Informational Note No. 1: See 314.27(B) for requirements on floor boxes used for receptacles located in the floor.

Informational Note No. 2: See 518.1for requirements on assembly occupancies designed for 100 or more persons.

ARTICLE 215
Feeders

215.4 Feeders with Common Neutral Conductor.

(A) Feeders with Common Neutral. Up to three sets of 3-wire feeders or two sets of 4-wire or 5-wire feeders shall be permitted to utilize a common neutral.

(B) In Metal Raceway or Enclosure. Where installed in a metal raceway or other metal enclosure, all conductors of all feeders using a common neutral conductor shall be enclosed within the same raceway or other enclosure as required in 300.20.

215.13 Multifamily Dwellings. Individual units of multifamily dwellings shall not be supplied by more than one feeder except by special permission from the authority having jurisdiction.

215.14 Dwelling Units Supplied Through Other Dwelling Units.
Feeder conductors supplying an individual dwelling unit shall not pass through the interior of another dwelling unit if that dwelling unit is located on a different unit lot of a unit lot subdivision. A unit lot subdivision divides a development site into separate unit lots that allow for separate ownership.

Informational Note: See SMC 23.22.062 for information on unit lot subdivisions.

ARTICLE 220
Branch-Circuit, Feeder, and Service Load

220.42 Lighting Load for Non-Dwelling Occupancies.

(A) General. A unit load of not less than that specified in Table 220.42(A) for non-dwelling occupancies and the floor area determined in 220.5(C) shall be used to calculate the minimum lighting load. Motors rated less than 1⁄8 HP and connected to a lighting circuit shall be considered general lighting load.

Informational Note: The unit values of Table 220.42(A) are based on minimum load conditions and 80 percent power factor and might not provide sufficient capacity for the installation contemplated.

(B) Energy Code. Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated using the unit values specified in the energy code where the following conditions are met:

~~(((1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.~~

~~(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted.~~))

(1) The demand factors specified in 220.45 are not applied to the general lighting load.

(2) The continuous load multiplier of 125 percent shall be applied.

Informational Note: See Section 405 of the 2021 Seattle Energy Code for the unit values.

220.51 Fixed Electric Space Heating.
Fixed electric space-heating loads shall be calculated at 100 percent of the total connected load. However, in no case shall a feeder or service load current rating be less than the rating of the largest branch circuit supplied.

Exception: ((~~If reduced loading of the conductors results from units operating on duty cycle or intermittently, or from all units not operating at the same time, the authority having jurisdiction shall be permitted to grant permission for feeder and service conductors to have an ampacity less than 100 percent if the conductors have an ampacity for the load so determined.~~)) A demand factor of 75 percent of the installed heating capacity may be used in sizing service entrance and feeder equipment for dwelling, commercial, and industrial occupancies when electric service is provided to four or more fixed space heaters, or electric furnaces individually controlled. These exceptions shall not apply when optional calculations allowed by Section 220.84 are used.

220.53 Appliance Load — Dwelling Unit(s).
Applying a demand factor of 75 percent to the nameplate rating load of four or more appliances rated 1⁄4 hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling shall be permitted. This demand factor shall not apply to the following:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space heating equipment

(4) Air-conditioning equipment

(5) Electric vehicle supply equipment (EVSE)

***N* 220.57 Electric Vehicle Supply Equipment (EVSE) Load.**
The EVSE load shall be calculated ((~~at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger~~)) in accordance with the requirements of Seattle Electrical Code Article 625.

***N* 220.70 Energy Management Systems (EMSs).**
If an energy management system (EMS) is used to limit the current to a feeder or service in accordance with 750.30, a single value equal to the maximum ampere setpoint of the EMS shall be permitted to be used in load calculations for the feeder or service.

The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations.

For new service installations, no branch-circuit, feeder or service load calculations required under Article 220 may be reduced by EMS.

220.84 Multifamily Dwelling.

(A) Feeder or Service Load. It shall be permissible to calculate the load of a feeder or service that supplies three or more dwelling units of a multifamily dwelling in accordance with Table 220.84(B) instead of Part III of this article if all the following conditions are met:

(1) No dwelling unit is supplied by more than one feeder.

(2) Each dwelling unit is equipped with electric cooking equipment.

Exception: When the calculated load for multifamily dwellings without electric cooking in Part III of this article exceeds that calculated under Part IV for the identical load plus electric cooking (based on 8 kW per unit), the lesser of the two loads shall be permitted to be used.

(3) Each dwelling unit is equipped with either electric space heating or air conditioning, or both. Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

Exception: When the calculated load for multifamily dwellings without electric heating or air conditioning, or both in Part III of this article exceeds that calculated under Part IV for the identical load plus electric heating (based on 5 W per square foot or the actual heat loss calculations based on the energy code at 150% as approved by the mechanical review in BTU), the lesser of the two loads shall be permitted to be used.

(B) House Loads. House loads shall be calculated in accordance with Part III of this article and shall be in addition to the dwelling unit loads calculated in accordance with Table 220.84(B).

(C) Calculated Loads. The calculated load to which the demand factors of Table 220.84(B) apply shall include the following:

(1) 33 volt-amperes/m2 or 3 volt-amperes/ft2 for general lighting and general-use receptacles

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

a. All appliances, including EV supply equipment when supplied from a unit, that are fastened in place, permanently connected, or located to be on a specific circuit

b. Ranges, wall-mounted ovens, counter-mounted cooking units

c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

d. Water heaters

(4) The nameplate ampere or kVA rating of all permanently connected motors not included in item (3)

(5) The larger of the air-conditioning load or the fixed electric space-heating load

ARTICLE 225
Outside Branch Circuits and Feeders

225.17 Masts as Supports. Only feeder or branch-circuit conductors specified within this section shall be permitted to be attached to the feeder and/or branch-circuit mast. Masts used for the support of final spans of feeders or branch circuits shall be installed in accordance with((~~225.17(A) and (B)~~)) 230.28.

(((~~**(A) Strength.** The mast shall have adequate strength or be supported by braces or guy wires to safely withstand the strain imposed by the overhead feeder or branch-circuit conductors. Hubs intended for use with a conduit serving as a mast for support of feeder or branch-circuit conductors shall be identified for use with a mast.~~

~~**(B) Attachment.** Feeder and/or branch-circuit conductors shall not be attached to a mast where the connection is between a weatherhead or the end of the conduit and a coupling where the coupling is located above the last point of securement to the building or other structure, or where the coupling is located above the building or other structure~~.))

Δ **225.31 Disconnecting Means.**

N **(A) General.** Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

Δ **(B) Location.** The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. For the purposes of this section, the requirements in 230.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 5: If the secondary building(s) or structure(s) has a separate building disconnecting means meeting the requirements of this Code and this subsection. The disconnecting means must have an identification plate with at least one-half-inch high letters which identify:

(a) the building or structure served; and

(b) the disconnecting feeder disconnecting means, including that required by Articles 700, 701, or 702 of this Code for a generator, is considered to be in the building if installed on the outside of the building or structure or within sight of and within 15 feet of the building or structure. The building disconnecting means may supply only one building or structure unless means function as the building or structure main disconnect(s).

(C) A Generator Disconnecting Means. A generator disconnecting means, is not required to be suitable for use as service equipment when there is a feeder disconnecting means, located elsewhere on the premises, with overcurrent protection sized for the feeder conductors.

Informational Note: WAC 296-46B-225.031 requirements for the location of outside feeder disconnecting means is incorporated herein.

ARTICLE 230
Services

Δ 230.1 ((~~Scope~~)) General.

(A) Scope. This article covers service conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements.

Informational Note No. 1: See Informational Note Figure 230.1 in 2023 National Electrical Code.

Informational Note No. 2: See Part V of Article 235 for services over 1000 volts ac or 1500 volts dc, nominal.

(B) Service Requirements. The serving utility shall be consulted by the owner, the owner's agent, or the contractor making the installation to ensure compliance with the utility's requirements for electrical service connection. This includes, but is not limited to, requirements for location, clearances, and equipment.

Informational Note: See Seattle City Light's *Requirements for Electrical Service Connection* for information on specific utility requirements for service connection.

230.2 Number of Services.
A building or other structure served shall be supplied by only one service unless permitted in 230.2(A) through (D). For the purpose of 230.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.

(A) Special Conditions. Additional services shall be permitted to supply the following:
(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Interconnected electric power production sources

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(B) Special Occupancies. By special permission, additional services shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more services necessary

(C) Capacity Requirements. Additional services shall be permitted under any of the following:

(1) Where the capacity requirements are in excess of 2000 amperes at a supply voltage of 1000 volts or less

(2) Where the load requirements of a single-phase installation are greater than the serving agency normally supplies through one service

(3) By special permission

(4) Electrical vehicle supply equipment (EVSE)

(D) Different Characteristics. Additional services shall be permitted for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

(E) Identification. Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders, and branch circuits supplying that building or structure and the area served by each. See 225.37.

230.4 Service Entrance Conductors Serving Development Sites.
Service entrance conductors from one development site shall not serve another development site or premises.

230.5 Types of Services.
All services shall be grounded single-phase or grounded three-phase 4-wire systems. Three-phase 3-wire services shall not be installed unless prior approval is granted by the utility and the authority having jurisdiction.

230.12 Service Point Connection.
Service point connections shall comply with paragraphs (A), (B) or (C) below.

(A) Overhead Service-drop. For overhead service-drop conductors from the utility pole to the point of attachment to the building, connections of the service entrance conductors shall be at a weatherhead outside the building.

(B) Underground Service Connections Outside of Buildings. For underground service connections outside of buildings, connection shall be made in one of the following:

(1) a service terminal box or current transformer cabinet;

(2) a handhole or power transformer installed outdoors in accordance with requirements of the utility, the Seattle Building Code, or any other applicable ordinance;

(3) A meter socket(s) of 200 amperes minimum size, direct-metered;

(4) A termination compartment of service equipment that is used exclusively for the connection of the utility distribution system.

(C) Underground Service Connections Inside of Buildings. For underground service connections inside of buildings, connection shall be made at one of the following:

(1) Where utility-supplied conductors are used:

(a) service terminal box or current transformer cabinet connected by no more than 457 mm (18 in.) of rigid steel or rigid nonmetallic conduit inside the building;

(b) a direct metered, meter socket of 200 amperes minimum size mounted in a perimeter wall of a single-family dwelling connected by no more than 2.4 m (8 ft) of rigid steel or rigid nonmetallic conduit inside the building;

(c) a termination or current transformer section of built, sectionalized service equipment that is used exclusively for the connection of the utility distribution system. This section must be fed from underground or concrete encased conduit and the service equipment must be set directly on the floor or a concrete house

(2) a transformer vault within the building

230.20 Overhead Service Conductors.

For systems rated 1000 volts or less, service entrance conductors beyond the service point shall not be installed as overhead conductors.

230.22((~~Insulation or Covering.~~ ~~Individual conductors shall be insulated or covered.~~)) **Not adopted.**

((~~*Exception: The grounded conductor of a multiconductor cable shall be permitted to be bare.*~~))

230.23 ((~~Size and Ampacity~~)) Not adopted.

((~~**(A) General.** Conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Parts II through V of Article 220 and shall have adequate mechanical strength.~~

~~**(B) Minimum Size.** The conductors shall not be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.~~

~~*Exception: Conductors supplying only limited loads of a single branch circuit—such as small polyphase power, controlled water heaters, and similar loads—shall not be smaller than 12 AWG hard-drawn copper or equivalent.*~~

~~**(C) Grounded Conductors.** The grounded conductor shall not be less than the minimum size as required by 250.24(C).~~))

230.27 ((~~Means of Attachment.~~ ~~Multiconductor cables used for overhead service conductors shall be attached to buildings or other structures by fittings identified for use with service conductors. Open conductors shall be attached to fittings identified for use with service conductors or to noncombustible, nonabsorbent insulators securely attached to the building or other structure~~.)) **Not adopted.**

230.28 Service Masts as Supports. Only electrical utility((~~power service drop or overhead service~~)) conductors shall be ((~~permitted to be~~)) attached to a service mast. Service masts used for the support of electrical utility ((~~service drop or overhead service drops~~)) conductors shall ((~~be installed in accordance with 230.28(A) and (B).~~)) comply with all of the following:

(((~~**(A) Strength.** The service mast shall be of adequate strength or be supported by braces or guy wires to withstand safely the strain imposed by the service drop or overhead service conductors. Hubs intended for use with a conduit that serves as a service mast shall be identified for use with service-entrance equipment.~~

~~**(B) Attachment.** Service drop or overhead service conductors shall not be attached to a service mast between a weatherhead or the end of the conduit and a coupling, where the coupling is located above the last point of securement to the building or other structure or is located above the building or other structure.~~))

(1) Be of rigid steel galvanized conduit having a diameter no smaller than 51 mm (2 in.).

(2) Have raceway fittings identified for use with galvanized rigid steel (GRC).

(3) Support only electric utility conductors.

(4) Be attached to a bracket on the mast or other approved structure located with 610 mm (24 in.) of the mast.

(5) Support service conduits by one of the methods identified in WAC 296-46B-230 028 and drawings E-101 through E-103 with corresponding notes. Snuggle bars properly installed between wood framing members are permitted.

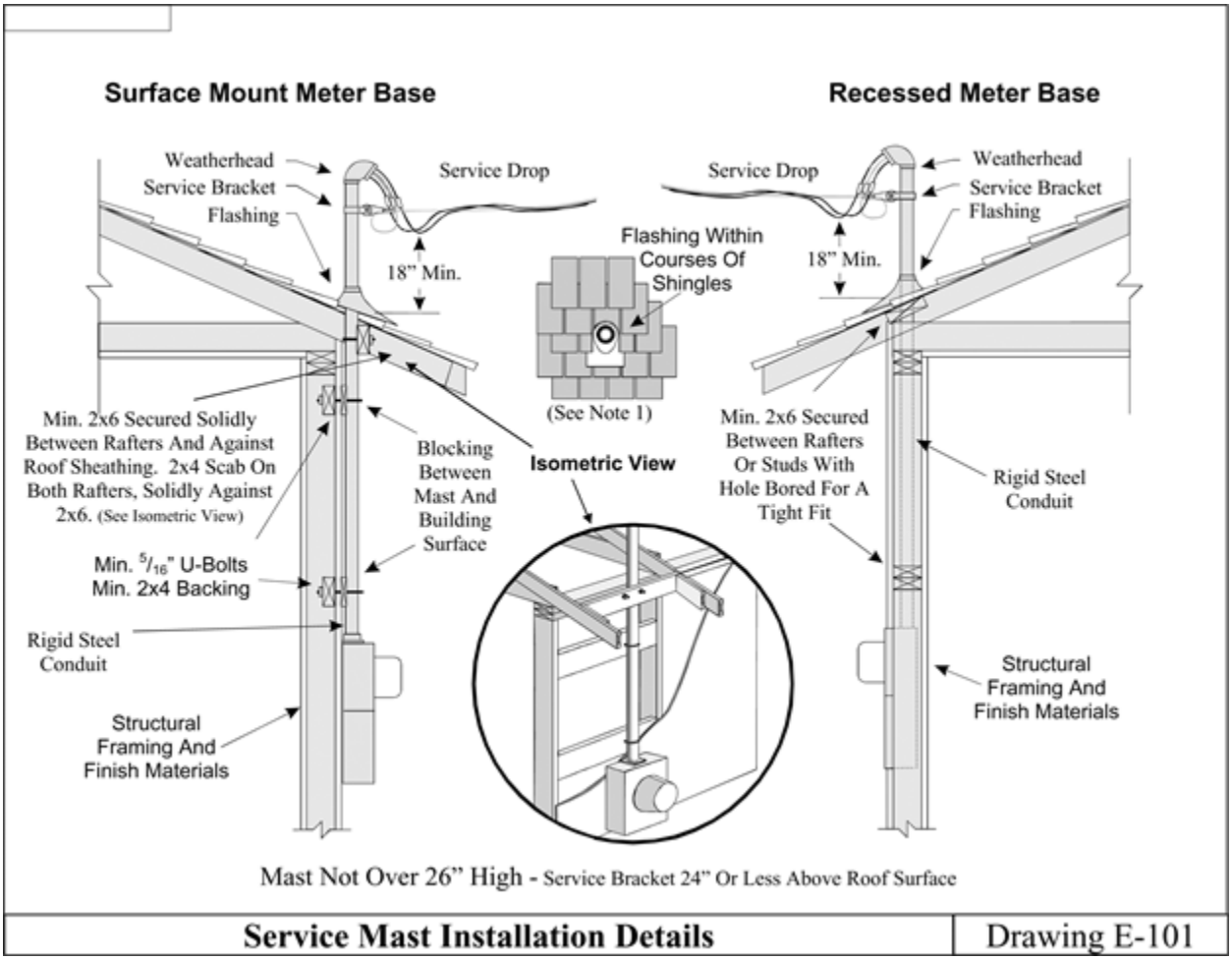
(6) Be rigidly supported with brackets or guy wires for masts extending over 661 mm (26 in.) from upper supporting means.

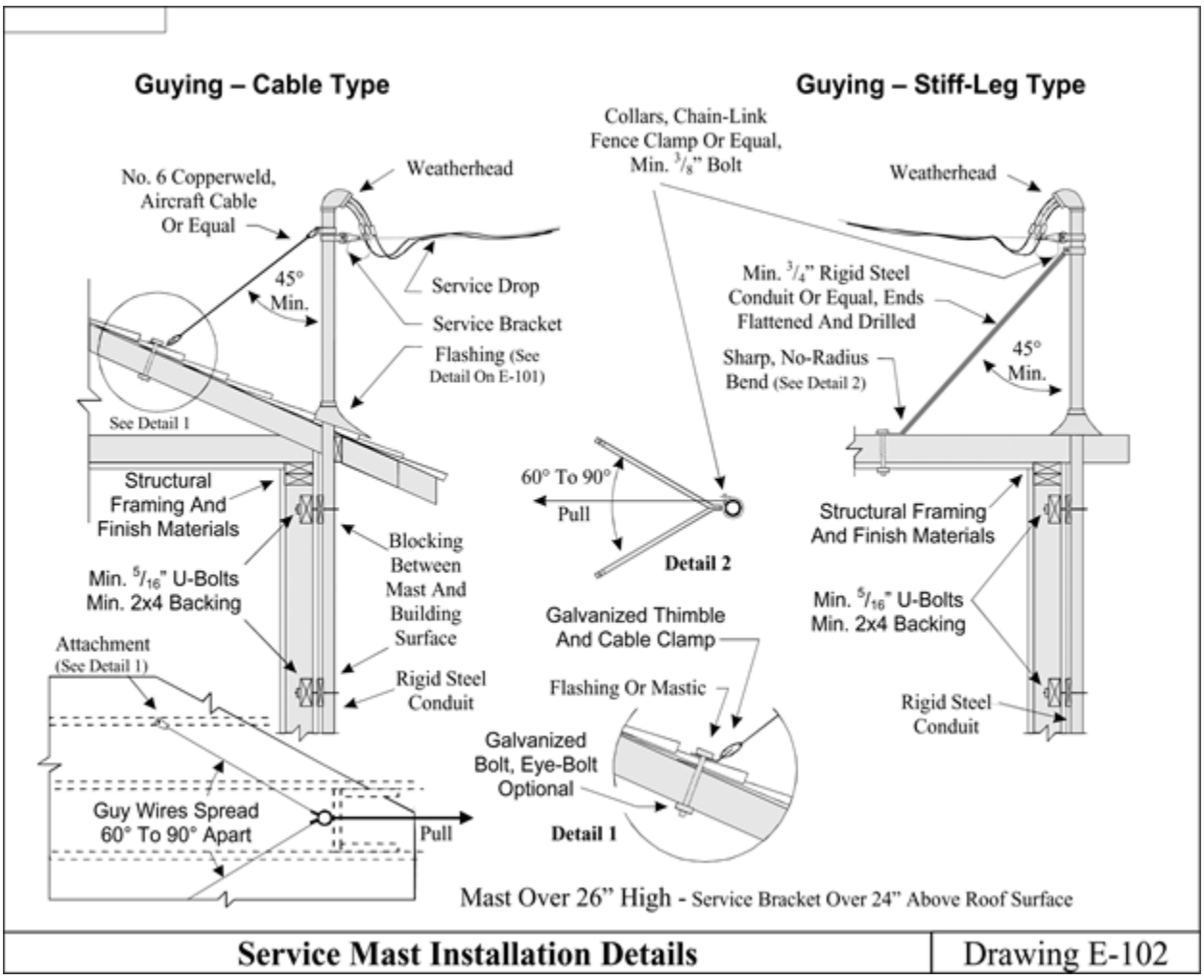
Informational Note: The serving utility shall be consulted for bracket and guy wire requirements.

(7) Have openings protected by approved neoprene or lead flashing to create a watertight seal where service conduit passes through the roof.

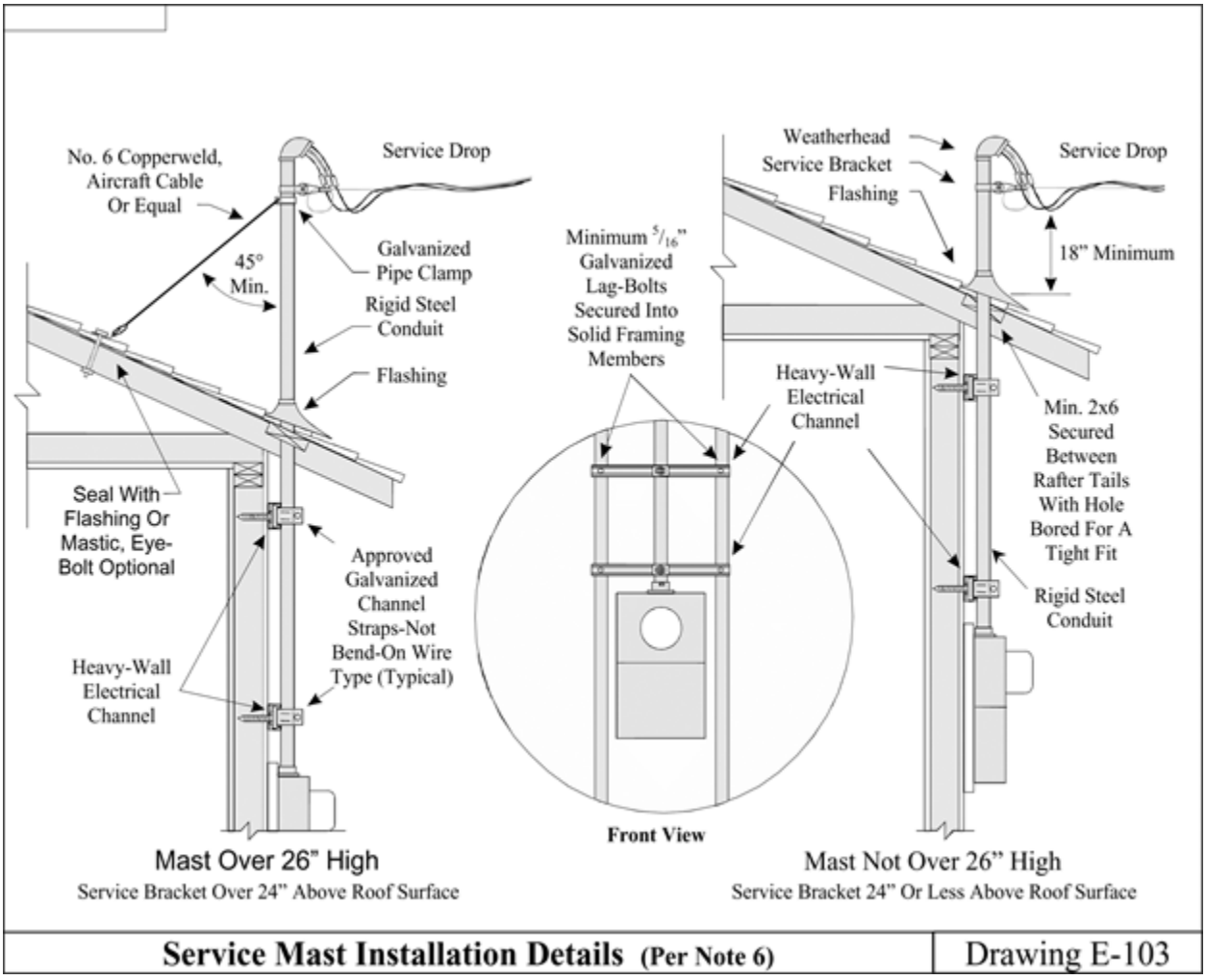
(8) Locate couplings only below the roofline and below a point of support for the mast.

Informational Note: WAC 296-46B-230.028, requirements for service mast installations, is incorporated herein.





Service Mast Installation Details | Drawing E-102



Notes to drawings E-101, E-102, and E-103

(1) An approved roof flashing must be installed on each mast where it passes through a roof. Plastic, nonhardening mastic must be placed between lead-type flashings and the conduit. Neoprene type flashings will also be permitted to be used.

(2) Masts must be braced, secured, and supported in such a manner that no pressure from the attached conductors will be exerted on a roof flashing, meter base, or other enclosures.

(3) Utilization of couplings for a mast is permitted only below the point the mast is braced, secured, or supported. There must be a minimum of two means of support above any couplings used. A properly installed cable or stiff leg type support qualifies as one of the two required means of support.

(4) Except as otherwise required by the serving utility, service mast support guys must be installed if the service drop attaches to the mast more than 24 inches above the roof line or if the service drop is greater than 100 feet in length from the pole or support. Masts for support of other than service drops must comply with this requirement as well.

(5) Intermediate support masts must be installed in an approved manner with methods identical or equal to those required for service masts.

(6) For altered services, where it is impractical to install U bolt mast supports due to interior walls remaining closed, it will be permissible to use other alternate mast support methods such as heavy gauge, galvanized, electrical channel material that is secured to two or more wooden studs with 5/16 inch diameter or larger galvanized lag bolts.

(7) Conductors must extend at least 18 inches from all mastheads to permit connection to the connecting overhead wiring.

230.29 Supports over Buildings <u>and Wires on or about Buildings or Structures over Water</u>. ((~~Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.~~))

Supports for service entrance conductors and service entrance conduit containing wires on or about buildings or structures over water shall comply with the following:

(1) All service entrance conductors for piers, docks, wharves, and other structures over water shall terminate in a disconnecting means or service equipment at the street side or end of such structure, or as otherwise approved by the authority having jurisdiction.

Exception: When the vault for the utility transformer is located over water, a disconnecting means for the service entrance conductors shall be provided immediately outside the vault at a location acceptable to the authority having jurisdiction.

Informational Note: For utility service conductors on piers, docks, or wharves, refer to "Requirements for Electric Service Connection," published by Seattle City Light.

(2) Service entrance conduit containing wires not protected by circuit breakers or switches and fuses shall follow and be supported on parapets or other walls and shall not be laid upon or across roofs.
(3) All service entrance conduits in the Fire District shall terminate on the side of the building nearest to the lines or mains of the utility. The service shall not terminate over adjacent private property, and shall extend to the street or alley wall of the buildings.

Informational Note: The Seattle Building Code defines "Fire District" in Chapter 2.

(4) Open wiring for service conductors shall contact the building at only one point except where the utility will agree to contact the building at more than one point.
(5) No wire access fittings or junction boxes of any type shall be permitted within 4.6 m (15 ft) of the ground level on street, alley, or driveway margins.

230.30 Installation.

(A) Insulation. Underground service conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) *Bare copper used in a raceway*

(2) *Bare copper for direct burial where bare copper is approved to be suitable for the soil conditions*

(3) *Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use*

(4) *Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial*

Δ **(B) Wiring Methods.** Underground service conductors shall be installed in accordance with the applicable requirements of this Code covering the type of wiring method used and shall be limited to the following methods:

(1) RMC conduit

(2) IMC conduit

(3) Type NUCC conduit

(4) HDPE conduit

(5) PVC conduit

(6) RTRC conduit

(((~~(7) Type IGS cable~~

~~(8) Type USE conductors or cables~~

~~(9) Type MV or Type MC cable identified for direct burial applications~~))

(10) Type MI cable, where suitably protected against physical damage and corrosive conditions

(((~~(11) Type TC-ER cable where identified for service entrance use and direct burial applications~~))

230.40 Service-Entrance Conductor Sets.

(A) Number of Service-Entrance Conductor Sets. Each service drop, ((~~set of overhead service conductors~~)), set of underground service conductors, or service lateral shall supply only one set of service-entrance conductors.

Informational Note: See SEC 230.4 for additional information about service-entrance conductor sets serving development sites.

Exception No. 1: A building with more than one occupancy shall be permitted to have one set of service-entrance conductors for each service, as permitted in 230.2, run to each occupancy or group of occupancies. If the number of service disconnect locations for any given classification of service does not exceed six, the requirements of 230.2(E) shall apply at each location. If the number of service disconnect locations exceeds six for any given supply classification, the following conditions shall apply:

(1) All service disconnect locations for all supply characteristics, together with any branch circuit or feeder supply sources, shall be clearly described using graphics or text, or both, on one or more plaques

(2) The plaques shall be located in an approved, readily accessible location(s) on the building or structure served and as near as practicable to the point(s) of attachment or entry(ies) for each service drop or service lateral and for each set of overhead or underground service conductors.

Exception No. 2: Where two to six service disconnecting means in separate enclosures are grouped at one location and supply separate loads from one service drop, ((~~set of overhead service conductors~~)), set of underground service conductors, or service lateral, one set of service-entrance conductors shall be permitted to supply each or several such service equipment enclosures.

Exception No. 3: A one-family dwelling unit and its accessory structures shall be permitted to have one set of service-entrance conductors run to each from a single service drop, ((~~set of overhead service conductors~~,)) set of underground service conductors, or service lateral.

Exception No. 4: Two-family dwellings, multifamily dwellings, and multiple occupancy buildings shall be permitted to have one set of service-entrance conductors installed to supply the circuits covered in 210.25.

Exception No. 5: One set of service-entrance conductors connected to the supply side of the normal service disconnecting means shall be permitted to supply each or several systems covered by 230.82(5) or 230.82(6).

(B) Two-family and multiple-occupancy buildings. A second or additional service drop or lateral to a building having more than one occupancy will be permitted to be installed at a location separate from other service drops or laterals to the building, provided that all the following conditions are complied with:

(1) Each service drop or lateral must be sized in accordance with the NEC for the calculated load to be served by the conductors;

(2) Each service drop or lateral must terminate in listed metering or service equipment;

(3) Each occupant must have access to the occupant's service disconnecting means;

(4) No more than 6 service disconnects may be supplied from a single transformer;

(5) All service drops or laterals supplying a building must originate at the same transformer or power supply;

(6) A permanent identification plate must be placed at each service disconnect location that identifies all other service disconnect locations in or on the building, the area or units served by each, the total number of service disconnecting means on the building or structure and the area or units served. If a structure consists of multiple buildings (i.e., by virtue of fire separation), all service disconnects in or on the entire structure must be labeled to identify all service disconnects in or on the structure; and

(7) A permanent identification plate must be placed at each feeder disconnecting means identifying the area or units served if the feeder disconnecting means is remote from the area or unit served.

Informational Note: WAC 296-46B-230.040(5), requirements for second or additional service conductors, is incorporated herein with edits.

230.42 Minimum Size and Ampacity.

Δ **(A) General.** Service-entrance conductors shall have an ampacity of not less than the maximum load to be served. Conductors shall be sized not less than the largest of 230.42(A)(1) or (A)(2). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.14 and shall comply with 110.14(C). The maximum current of busways shall be that value for which the busway has been listed or labeled.

Informational Note: See UL 857, Standard for Safety for Busways, for information on busways.

N **(1) Continuous and Noncontinuous Loads.** Where the service-entrance conductors supply continuous loads or any combination of noncontinuous and continuous loads, the minimum service-entrance conductor size shall have an ampacity not less than the sum of the noncontinuous loads plus 125 percent of continuous loads.

Exception No. 1: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the sum of the continuous and noncontinuous load.

Exception No. 2: The sum of the noncontinuous load and the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating shall be permitted.

N **(2) Application of Adjustment or Correction Factors.** The minimum service-entrance conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

(B) Specific Installations. In addition to the requirements of 230.42(A), the minimum ampacity for ungrounded conductors for specific installations shall not be less than the rating of the service disconnecting means specified in 230.79(A) through (D).

(C) Grounded Conductors. The grounded conductor shall not be smaller than the minimum size as required by 250.24(D).

(D) Ungrounded Conductors. If the service conductors have a lesser ampacity than the rating of service equipment with multiple service disconnects permitted by Sections 230.90 or 310.15, or the equipment rating that they terminate in or on, an identification plate showing the ampacity of the conductors must be installed on the service equipment.

Informational Note: WAC 296-46B-230.042(6), requirement for labeling of service equipment, is incorporated herein with edits.

230.43 Wiring Methods for 1000 Volts, Nominal, or Less.
Service-entrance conductors shall be installed in accordance with the applicable requirements of this Code covering the type of wiring method used and shall be limited to the following methods:
(1) ((~~Open wiring on insulators~~)) Reserved

(2) ((~~Type IGS cable~~)) Reserved

(3) Rigid metal conduit (RMC)

(4) Intermediate metal conduit (IMC)

(5) ((~~Electrical metallic tubing (EMT)~~)) Reserved

(6) ((~~Electrical nonmetallic tubing~~)) Reserved

(7) ((~~Service-entrance cables~~)) Reserved

(8) ((~~Wireways~~)) Reserved

(9) Busways

(10) ((~~Auxiliary gutters~~)) Reserved

(11) Rigid polyvinyl chloride conduit (PVC)

(12) Cablebus

(13) ((~~Type MC cable~~)) Reserved

(14) Mineral-insulated, metal-sheathed cable, Type MI

(15) ((~~Flexible metal conduit (FMC) not over 1.8 m (6 ft) long or liquidtight flexible metal conduit (LFMC) not over 1.8 m (6 ft) long between a raceway, or between a raceway and service equipment, with a supply-side bonding jumper routed with the flexible metal conduit (FMC) or the liquidtight flexible metal conduit (LFMC) according to 250.102(A), (B), (C), and (E)~~))) Reserved

(16) ((~~Liquidtight flexible nonmetallic conduit LFNC~~)) Reserved

(17) High density polyethylene conduit (HDPE)

(18) Nonmetallic underground conduit with conductors (NUCC)

(19) Reinforced thermosetting resin conduit (RTRC)

(((~~(20) Type TC-ER cable where identified for use as service entrance conductors~~)))

(((~~(21) Flexible bus systems~~)))

Exception: Wiring methods per NEC 230.43 shall be permitted for service conductors within a building or structure when those conductors are protected by customer owned supply side overcurrent protection sized per NEC 240.4. Existing electrical metallic tubing, installed prior to October 1984, which is properly grounded and used for service entrance conductors may be permitted to remain if the conduit is installed in a nonaccessible location and is the proper size for the installed conductors.

Informational note: The requirements of WAC 296-46B-230 043 (7 & 8) are incorporated herein with edits

230.44 Cable Trays.

Cable tray systems ((~~shall~~)) may with prior approval of the authority having jurisdiction, be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:
(1) ((~~Type SE cable~~))

(2) ((~~Type MC cable~~))

(3) Type MI cable

(((~~(4) Type IGS cable~~

~~(5) Single conductors 1/0 and larger that are listed for use in cable tray~~

~~(6) Type TC-ER cable~~))

Such cable trays shall be identified with permanently affixed labels with the wording "Service-Entrance Conductors." The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service entrance conductors, provided a solid fixed barrier identified for use with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

230.46 Spliced and Tapped Conductors.
Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15 only by special permission of the authority having jurisdiction. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

Pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

230.50 Protection Against Physical Damage.

(A) Underground Service-Entrance Conductors. Underground service-entrance conductors shall be protected against physical damage in accordance with 300.5.

(B) All Other Service-Entrance Conductors. All other service entrance conductors, other than underground service entrance conductors, shall be protected against physical damage ((~~as specified in 230.50(B)(1) or (B)(2).~~

~~**(1) Service-Entrance Cables.** Service-entrance cables, where subject to physical damage, shall be protected by any of the following:~~

~~(1) Rigid metal conduit (RMC)~~

~~(2) Intermediate metal conduit (IMC)~~

~~(3) Schedule 80 PVC conduit~~

~~(4) Electrical metallic tubing (EMT)~~

~~(5) Reinforced thermosetting resin conduit (RTRC)~~

~~(6) Other approved means~~

~~**(2) Other Than Service-Entrance Cables.** Individual open conductors and cables, other than service-entrance cables, shall not be installed within 3.0 m (10 ft) of grade level or where exposed to physical damage.~~

~~*Exception: Type MI and Type MC cable shall be permitted within 3.0 m (10 ft) of grade level where not exposed to physical damage or where protected in accordance with 300.5(D).))~~

230.51 ((~~Mounting Supports.~~ ~~Service-entrance cables or individual open service-entrance conductors shall be supported as specified in 230.51(A), (B), or (C).~~

~~**(A) Service-Entrance Cables.** Service-entrance cables shall be supported by straps or other approved means within 300 mm (12 in.) of every service head, gooseneck, or connection to a raceway or enclosure and at intervals not exceeding 750 mm (30 in.).~~

~~**(B) Other Cables.** Cables that are not approved for mounting in contact with a building or other structure shall be mounted on insulating supports installed at intervals not exceeding 4.5 m (15 ft) and in a manner that maintains a clearance of not less than 50 mm (2 in.) from the surface over which they pass.~~

~~**(C) Individual Open Conductors.** Individual open conductors shall be installed in accordance with Table 230.51(C). Where exposed to the weather, the conductors shall be mounted on insulators or on insulating supports attached to racks, brackets, or other approved means. Where not exposed to the weather, the conductors shall be mounted on glass or porcelain knobs.~~)) Not adopted.

Table 230.51(C), Supports, is not adopted.

230.52 ((~~Individual Conductors Entering Buildings or Other Structures.~~ ~~Where individual open conductors enter a building or other structure, they shall enter through roof bushings or through the wall in an upward slant through individual, noncombustible, nonabsorbent insulating tubes. Drip loops shall be formed on the conductors before they enter the tubes~~.)) Not adopted.

230.54 Overhead Service-Drop Locations.

(A) Service Head. Service raceways shall be equipped with a service head at the point of connection to service-drop or ((~~overhead service~~)) conductors. The service head shall be listed for use in wet locations.

(B) ((~~Service-Entrance Cables Equipped with Service Head or Gooseneck.~~ ~~Service-entrance cables shall be equipped with a service head. The service head shall be listed for use in wet locations.~~)) **Reserved.**

((~~*Exception: Type SE cable shall be permitted to be formed in a gooseneck and taped with a self-sealing weather-resistant thermoplastic.*~~))

(C) Service Heads and Goosenecks Above Service-Drop. ((~~or Overhead Service Attachment.~~)) Service heads on raceways or service-entrance ((~~cables~~)) conductors and goosenecks in service-entrance cables shall be located above the point of attachment of the service-drop ((~~or overhead service conductors~~)) to the building or other structure.

Exception: Where it is impracticable to locate the service head or gooseneck above the point of attachment, the service head or gooseneck location shall be permitted not farther than 600 mm (24 in.) from the point of attachment.

(D) ((~~Secured.~~ ~~Service-entrance cables shall be held securely in place.~~)) **Reserved.**

(E) Separately Bushed Openings. Service heads shall have conductors of different potential brought out through separately bushed openings.

((~~*Exception: For jacketed multiconductor service-entrance cable without splice.*~~))

(F) Drip Loops. Drip loops shall be formed on individual conductors. To prevent the entrance of moisture, service entrance conductors shall be connected to the service-drop ((~~or overhead service~~)) conductors either (1) below the level of the service head or (2) below the level of the termination of the service-entrance cable sheath.

(G) Arranged That Water Will Not Enter Service Raceway or Equipment. Service-entrance ((and overhead service)) conductors shall be arranged so that water will not enter service raceway or equipment.

(H) Length at Weatherhead. Service-entrance conductors shall extend at least 457 mm (18 in.) from the weatherhead to allow connection. Where multiple service-entrance raceways are provided, each service-entrance conductor shall extend at least 762 mm (30 in.) from the weatherhead to allow connection.

Informational Note: Drawings E-101, E-102, and E-103 adopted in Section 230.28 of this Code and contained in WAC 296-46B-230 together with the associated drawing notes, illustrate code compliant installations.

230.70 General.
Means shall be provided to disconnect all ungrounded conductors in a building or other structure from the service conductors.

(A) Location. The service disconnecting means shall be installed in accordance with 230.70(A)(1), (A)(2), and (A)(3).

(1) Readily Accessible Location. ((~~The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.~~)) Service disconnecting means shall be in a readily accessible location including after any subsequent building alterations or additions as follows:

(a) Outside location. Service disconnecting means will be permitted on the building or structure or within sight and within 15 feet of the building or structure served. The building disconnecting means may supply only one building or structure. The service disconnecting means must have an identification plate with one-half-inch high letters identifying:

(1) The building or structure served; and

(2) Its function as the building or structure main service disconnect(s).

Informational Note: WAC 296-46B-230.001, requirements for inside and outside readily accessible location, are incorporated herein.

(b) Inside location. When the service disconnecting means is installed inside the building or structure, it must be located so that the service raceway extends no more than 15 feet inside the building or structure.

(2) Bathrooms and Other Locations. Service disconnecting means shall not be installed in bathrooms, toilet rooms, shower rooms, clothes closets, cupboards, attics, under or over stairways, within any stairway enclosure, nor above washers, water heaters, sinks, plumbing fixtures, drain boards, ranges or dryers.

Exception: In one- and two-family dwellings, service disconnecting means may be installed over a stairway landing that has no less than the clear working space required by this Code.

(3) Remote Control. Where a remote control device(s) is used to actuate the service disconnecting means, the service disconnecting means shall be located in accordance with 230.70(A)(1).

(**B) Marking**. Each service disconnect shall be permanently marked to identify it as a service disconnect.

Δ **(C) Suitable for Use.** Each service disconnecting means shall be suitable for the prevailing conditions. Service equipment installed in hazardous (classified) locations shall comply with the hazardous location requirements.

Δ 230.82 Equipment Connected to the Supply Side of Service Disconnect.
Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(1) Existing installations of cable limiters by special permission of the authority having jurisdiction.

(2) Meters and meter sockets nominally rated not in excess of 1000 volts, if all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250. Taps under meter socket lugs shall not be permitted, except by prior approval from the authority having jurisdiction.

(3) Meter disconnect switches nominally rated not in excess of 1000 volts that have a short-circuit current rating equal to or greater than the available fault current, if all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250. A meter disconnect switch shall be capable of interrupting the load served. A meter disconnect shall be legibly field marked on its exterior in a manner suitable for the environment as follows:

METER DISCONNECT
NOT SERVICE EQUIPMENT

(4) Instrument transformers (current and voltage), impedance shunts, load management devices, surge arresters, and Type 1 surge-protective devices.

(5) Conductors used to supply energy management systems, circuits for standby power systems, fire pump equipment, and fire and sprinkler alarms, if provided with service equipment and installed in accordance with requirements for service-entrance conductors.

(6) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources, if provided with a disconnecting means listed as suitable for use as service equipment, and overcurrent protection as specified in Part VII of Article 230.

(7) Control circuits for power-operable service disconnecting means, if suitable overcurrent protection and disconnecting means are provided.

(8) Ground-fault protection systems or Type 2 surge-protective devices, where installed as part of listed equipment, if suitable overcurrent protection and disconnecting means are provided.

(9) Connections used only to supply listed communications equipment under the exclusive control of the serving electric utility, if suitable overcurrent protection and disconnecting means are provided. For installations of equipment by the serving electric utility, a disconnecting means is not required if the supply is installed as part of a meter socket, such that access can only be gained with the meter removed.

(10) Emergency disconnects in accordance with 230.85(B)(2) and (B)(3), if all metal housings and enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.

(11) Meter-mounted transfer switches nominally rated not in excess of 1000 volts that have a short-circuit current rating equal to or greater than the available fault current. A meter-mounted transfer switch shall be listed and be capable of transferring the load served. A meter-mounted transfer switch shall be marked on its exterior with both of the following:

a. Meter-mounted transfer switch

b. Not service equipment

(12) Control power circuits for protective relays where installed as part of listed equipment, if overcurrent protection and disconnecting means are provided.

(13) Current transformer cabinets shall contain only the main service conductors, metering equipment, secondary wiring, and bonding conductors. One tap shall be permitted on the load side of the current transformers for a legally required standby service and one tap shall be permitted on the load side of the current transformers for a fire pump service. One additional normal power service tap from the current transformer enclosure may be made by special permission of the service utility. In a single-family dwelling, two connections shall be permitted on the load side of the current transformers. No other taps shall be permitted. Approved terminal lugs shall be provided for the main service conductors, and for all taps and bonding conductors.

(14) Listed service accessory bus gutters or termination boxes that are approved for use on the line side of service equipment. Junction and pull boxes are not permitted except as allowed in (6) of this section.

Δ 230.85 Emergency Disconnects.
For one- and two-family dwelling units, an emergency disconnecting means shall be installed.

N **(A) General.**

(1) Location. The disconnecting means shall be installed in a readily accessible outdoor location on or within sight of the dwelling unit.

Exception: Where the requirements of 225.41 are met, this section shall not apply.

(2) Rating. The disconnecting means shall have a short-circuit current rating equal to or greater than the available fault current.

(3) Grouping. If more than one disconnecting means is provided, they shall be grouped.

N **(B) Disconnects.** Each disconnect shall be one of the following:

(1) Service disconnect

(2) A meter disconnect integral to the meter mounting equipment not marked as suitable only for use as service equipment installed in accordance with 230.82

(3) Other listed disconnect switch or circuit breaker that is marked suitable for use as service equipment, but not marked as suitable only for use as service equipment, installed on the supply side of each service disconnect

Informational Note 1: Conductors between the emergency disconnect and the service disconnect in 230.85(2) and 230.85(3) are service conductors.

Informational Note 2: Equipment marked “Suitable only for use as service equipment” includes the factory marking “Service Disconnect”.

N **(C) Replacement.** Where existing service equipment is replaced, all of the requirements of this section shall apply only if the service ampacity is increased or decreased, or when any one of the following are relocated: service disconnects, meter bases, overhead service masts, or underground service risers.

~~*((Exception: Where only meter sockets, service entrance conductors, or related raceways and fittings are replaced, the requirements of this section shall not apply.))*~~

Informational note: The requirements and exceptions of WAC 296-46B-230 085 are incorporated herein with edits.

N **(D) Identification of Other Isolation Disconnects.**
Where equipment for isolation of other energy source systems is not located adjacent to the emergency disconnect required by this section, a plaque or directory identifying the location of all equipment for isolation of other energy sources shall be located adjacent to the disconnecting means required by this section.

Informational Note: See 445.18, 480.7, 705.20, and 706.15 for examples of other energy source system isolation means.

N **(E) Marking.**

N **(1) Marking Text.** The disconnecting means shall be marked as follows:

(1) Service disconnect

EMERGENCY DISCONNECT, SERVICE DISCONNECT

(2) Meter disconnects installed in accordance with 230.82(3) and marked as follows:

EMERGENCY DISCONNECT, METER DISCONNECT,
NOT SERVICE EQUIPMENT

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are marked suitable for use as service equipment and marked as follows:

EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT

N **(2) Marking Location and Size.** Markings shall comply with 110.21(B) and both of the following:

(1) The marking or labels shall be located on the outside front of the disconnect enclosure with red background and white text.
(2) The letters shall be at least 13 mm (1⁄2 in.) high.

230.90 Where Required.
Each ungrounded service conductor shall have overload protection. If the service conductors have a lesser ampacity than the rating of service equipment with multiple service disconnects permitted by Sections 230.90 or 310.15 of this Code, an identification plate showing the ampacity of the conductors must be installed on the service equipment.

Informational Note: WAC 296-46B-230.042(6), requirements for service conductor size and rating, is incorporated herein with edits.

Δ **(A) Ungrounded Conductor.** Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the ampacity of the conductor. A set of fuses shall be considered all the fuses required to protect all the ungrounded conductors of a circuit. Single-pole circuit breakers, grouped in accordance with 230.71(B), shall be considered as one protective device.

Exception No. 1: For motor-starting currents, ratings that comply with 430.52, 430.62, and 430.63 shall be permitted.

Exception No. 2: Fuses and circuit breakers with a rating or setting that complies with 240.4(B) or (C) and 240.6 shall be permitted.

Exception No. 3: Two to six circuit breakers or sets of fuses shall be permitted as the overcurrent device to provide the overload protection. The sum of the ratings of the circuit breakers or fuses shall be permitted to exceed the ampacity of the service conductors, provided the calculated load does not exceed the ampacity of the service conductors.

Exception No. 4: Overload protection for fire pump supply conductors shall comply with 695.4(B)(2)(a).

Exception No. 5: Overload protection in accordance with the conductor ampacities of 310.12 shall be permitted for single-phase dwelling services.

(B) Not in Grounded Conductor. No overcurrent device shall be inserted in a grounded service conductor except a circuit breaker that simultaneously opens all conductors of the circuit

230.95 Ground-Fault Protection of Equipment.
Ground-fault protection of equipment shall be provided for solidly grounded wye electric services of more than 150 volts to ground but not exceeding 1000 volts phase-to-phase for each service disconnect rated 1000 amperes or more. The grounded conductor for the solidly grounded wye system shall be connected directly to ground through a grounding electrode system, as specified in 250.50, without inserting any resistor or impedance device.

The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed or the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.

Exception: The ground-fault protection provisions of this section shall not apply to a service disconnect for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

(A) Setting. The ground-fault protection system shall operate to cause the service disconnect to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 1200 amperes, and the maximum time delay shall be one second for ground-fault currents equal to or greater than 3000 amperes.

(B) Fuses. If a switch and fuse combination is used, the fuses employed shall be capable of interrupting any current higher than the interrupting capacity of the switch during a time that the ground-fault protective system will not cause the switch to open.

(C) Performance Testing. The ground-fault protection system shall be performance tested when first installed on site. ((~~This testing shall be conducted by a qualified person(s) using a test process of primary current injection, in accordance with instructions that shall be provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.~~))

The testing shall verify that the system is installed and operates in accordance with the manufacturer's instructions. Testing shall be performed by qualified personnel having proper equipment to complete the acceptance testing in the manner prescribed by the manufacturer. The testing personnel shall sign a written performance acceptance test record. The record shall provide testing details including, but not limited to, measurements and trip settings used during the test.

The written acceptance test record, together with a copy of the manufacturer's performance testing instructions, shall be made available to the inspector for the authority having jurisdiction.

(D) Added Ground-Fault Protection System. Ground fault protection systems added to an existing energized service shall be tested and inspected prior to being placed into service.

Informational Note No. 1: Ground-fault protection that functions to open the service disconnect affords no protection from faults on the line side of the protective element. It serves only to limit damage to conductors and equipment on the load side in the event of an arcing ground fault on the load side of the protective element.

Informational Note No. 2: This added protective equipment at the service equipment could make it necessary to review the overall wiring system for proper selective overcurrent protection coordination. Additional installations of ground-fault protective equipment might be needed on feeders and branch circuits where maximum continuity of electric service is necessary.

Informational Note No. 3: Where ground-fault protection is provided for the service disconnect and interconnection is made with another supply system by a transfer device, means or devices could be needed to ensure proper ground-fault sensing by the ground-fault protection equipment.

Informational Note No. 4: See 517.17(A) for information on where an additional step of ground-fault protection is required for hospitals and other buildings with critical areas or life support equipment.

Informational Note No. 5: The requirements of WAC 256-46B-230 095 are incorporated herein with edits

ARTICLE 235
Branch Circuits, Feeders, and Services Over 1000 Volts ac, 1500 Volts dc, Nominal

N **235.402 Service-Entrance Conductors.**
Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).

N **(A) Conductor Size.** Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.

N **(B) Wiring Methods.** Service-entrance conductors shall be installed by one of the following wiring methods ((~~covered in 305.3 and 305.15.~~)):

(1) Rigid metal conduit (RMC)

(2) Intermediate metal conduit (IMC)

(3) Schedule 80 rigid polyvinyl chloride (PVC) conduit

(4) Busways

(5) Cablebus

(6) Cable trays only with prior permission of the authority having jurisdiction.

Informational Note No. 2: WAC 296-46B-235 402 requirements are incorporated herein.

ARTICLE 240
Overcurrent Protection

240.24 Location in or on Premises.

(A) Accessibility. ((~~Circuit breakers and switches containing fuses~~)) Equipment containing overcurrent devices shall be readily accessible and installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, unless one of the following applies:

(1) For busways, as provided in 368.17(C).

(2) For supplementary overcurrent protection, as described in 240.10.

(3) For overcurrent protective devices, as described in 225.40 and 230.92.

(4) For overcurrent protective devices adjacent to utilization equipment that they supply, access shall be permitted to be by portable means.

Exception: The use of a tool shall be permitted to access overcurrent protective devices located within listed industrial control panels, within enclosures designed for hazardous (classified) locations or enclosures to protect against environmental conditions. An enclosure within the scope of this exception, and all overcurrent protective device(s) within such enclosures as judged with the enclosure open, shall comply with the accessibility provisions of 240.24(A).

(B) Occupancy. Each occupant shall have ready access to all overcurrent devices protecting the conductors supplying that occupancy, unless otherwise permitted in 240.24(B)(1) and (B)(2).

(1) Service and Feeder Overcurrent Protective Devices. Where electric service and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the service overcurrent protective devices and feeder overcurrent protective devices supplying more than one occupancy shall be permitted to be accessible only to authorized management personnel in the following:

(1) Multiple-occupancy buildings

(2) Guest rooms or guest suites

(3) Boarding homes and congregate living facilities or similar occupancies.

(2) Branch-Circuit Overcurrent Protective Devices. Where electric service and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the branch-circuit overcurrent protective devices supplying any guest rooms, guest suites, or sleeping rooms in dormitory units without permanent provisions for cooking shall be permitted to be accessible only to authorized management personnel.

(3) Dwelling Units, Accessory Dwelling Unit, Two-Family and Multifamily Occupancies. Branch circuit overcurrent devices shall be located either within the dwelling unit that they serve or in common areas accessible to all occupants.

(C) Not Exposed to Physical Damage. Overcurrent protective devices shall be located where they will not be exposed to physical damage.

(1) Exterior installations: Where this code and/or manufacturer's instructions do not specify minimum height requirements for equipment enclosures, enclosures containing an overcurrent protective device installed outdoors shall be installed so the bottom of the enclosure is not less than 24 inches above finished grade unless:

(1) The equipment enclosure or listed equipment on which the enclosure is mounted is approved for pad-, floor-, ground-, dock-, or pier-mounting; or-
(2) The equipment enclosure is located over concrete or asphalt paving that extends three or more feet horizontally from the surface of the enclosure.

Informational Note No. 1: See 110.11 for information on deteriorating agents that could cause physical damage.

Informational Note No. 2: The requirements of WAC 296-46B-240 024(C) are incorporated herein with edits.

(D) Not in Vicinity of Easily Ignitible Material. Overcurrent protective devices shall not be located in the vicinity of easily ignitible material, such as in clothes closets.

(E) Not Located in Bathrooms. Overcurrent protective devices, other than supplementary overcurrent protection, shall not be located in bathrooms, showering facilities, or locker rooms with showering facilities.

(F) Not Located over Steps. Overcurrent protective devices shall not be located over steps of a stairway.

Exception: If the overcurrent protective device is a part of a panelboard that is being repaired or replaced in an existing location that was approved at the time of installation, the installation shall be allowed over steps.

Informational Note: The exception of WAC 296-46B-240 024(F) is incorporated herein with edits.

Δ 240.33 Vertical Position.

Enclosures for overcurrent devices shall be mounted in a vertical position. Circuit breaker enclosures shall be permitted to be installed horizontally where the circuit breaker is installed in accordance with 240.81. Listed busway plug-in units shall be permitted to be mounted in orientations corresponding to the busway mounting position, when in accordance with 240.81 and 404.7.

ARTICLE 250
Grounding and Bonding

250.50 Grounding Electrode System.
All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. If none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.

Except for mobile/manufactured homes, a concrete encased grounding electrode must be installed and used at each new building or structure that is built upon a permanent concrete foundation. The electrode must comply, with NEC 250.52 (A)(3).

Exception No. 1: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system if the rebar is not accessible for use without disturbing the concrete. Where a concrete encased electrode is not part of the grounding electrode system of an existing building or structure, a concrete encased electrode that may be available as a result of a new addition to the foundation is not required to be connected to service equipment that existed before the addition.

Exception No.2: If the concrete encased grounding electrode is not available for connection, a ground ring or other grounding electrode shall be installed per NEC 250 and verified to measure 25 ohms or less to ground by the inspector. If the concrete encased grounding electrode has not been inspected and approved, but is available for connection, the electrode(s) shall be verified to measure 25 ohms or less to ground by the inspector. A ground resistance test fee shall apply.

Informational note: The requirements and exceptions of WAC 296-46B-250 052 are incorporated herein with edits.

250.53 Grounding Electrode System Installation.

(A) Rod, Pipe, and Plate Electrodes. Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel. Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3).

Δ **(1) Below Permanent Moisture Level.** If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level.

(2) Supplemental Electrode Required. A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:

(1) Rod, pipe, or plate electrode

(2) Grounding electrode conductor

(3) Grounded service-entrance conductor

(4) Nonflexible grounded service raceway

(5) Any grounded service enclosure

Exception: ((~~If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.~~))A supplemental electrode shall not be required for a temporary service, a utility pole mounted service, or where only one of the following service components is replaced:
(1) Overhead service mast

(2) Meter base enclosure

(3) Service disconnect and/or emergency disconnect

(3) Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than ((~~1.8 m (6 ft)~~)) 2.5 m (8 ft) apart.

Informational Note: The paralleling efficiency of rods is increased by spacing them twice the length of the longest rod.

(4) Rod and Pipe Electrodes. The electrode shall be installed such that at least 2.44 m (8 ft) of length is in contact with the soil. It shall be driven to a depth of not less than 2.44 m (8 ft) except that, where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from the vertical or, where rock bottom is encountered at an angle up to 45 degrees, the electrode shall be permitted to be buried in a trench that is at least 750 mm (30 in.) deep. The upper end of the electrode shall be flush with or below ground level unless the aboveground end and the grounding electrode conductor attachment are protected against physical damage as specified in 250.10.

(5) Plate Electrode. Plate electrodes shall be installed not less than 750 mm (30 in.) below the surface of the earth.

Δ **(B) Electrode Spacing.** If more than one of the electrodes of the type specified in 250.52(A)(5) or (A)(7) are used, each electrode of one grounding system (including that used for strike termination devices) shall not be less than 1.83 m (6 ft) from any other electrode of another grounding system.

(C) Bonding Jumper. The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.

(D) Metal Underground Water Pipe. If used as a grounding electrode, metal underground water pipe shall meet the requirements of 250.53(D)(1) and (D)(2).

(1) Continuity. Continuity of the grounding path or the bonding connection to interior piping shall not rely on water meters or filtering devices and similar equipment.

(2) Supplemental Electrode Required. A metal underground water pipe shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). If the supplemental electrode is of the rod, pipe, or plate type, it shall comply with 250.53(A). The supplemental electrode shall be bonded to one of the following:

(1) Grounding electrode conductor

(2) Grounded service-entrance conductor

(3) Nonflexible grounded service raceway

(4) Any grounded service enclosure

(5) As provided by 250.32(B)

Exception: The supplemental electrode shall be permitted to be bonded to the interior metal water piping as specified in 250.68(C)(1).

(E) Supplemental Grounding Electrode Bonding Jumper Size. If the supplemental electrode is a rod, pipe, or plate electrode, that portion of the bonding jumper that is the sole connection to the supplemental grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum or copper-clad aluminum wire.

(F) Ground Ring. The ground ring shall be installed not less than 750 mm (30 in.) below the surface of the earth.

250.64 Grounding Electrode Conductor Installation.
Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (G).

(A) Aluminum or Copper-Clad Aluminum Conductors. Grounding electrode conductors of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

(1) Bare or covered conductors without an extruded polymeric covering shall not be installed where subject to corrosive conditions or be installed in direct contact with concrete.

(2) Terminations made within outdoor enclosures that are listed and identified for the environment shall be permitted within 450 mm (18 in.) of the bottom of the enclosure.

(3) Aluminum or copper-clad aluminum conductors external to buildings or equipment enclosures shall not be terminated within 450 mm (18 in.) of the earth.

(B) Securing and Protection Against Physical Damage. If exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members.

(1) Not Exposed to Physical Damage. A 6 AWG or larger copper, copper-clad aluminum, or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection.

(2) Exposed to Physical Damage. A 6 AWG or larger copper, copper-clad aluminum, or aluminum grounding electrode conductor exposed to physical damage shall be protected.((~~in rigid metal conduit (RMC), intermediate metal conduit (IMC), ((Schedule 80)) rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor.~~)) Grounding electrode conductors exposed to theft shall be considered exposed to physical damage. Grounding electrode conductors will be considered protected from physical damage when the conductor(s) are:

(1) Buried more than 12 inches deep in the earth outside the building's footprint;

(2) Encased or covered by 2 inches of concrete or asphalt;

(3) Located inside the building footprint and protected by the building's structural elements or when inside and determined, by the inspector, not to be subject to physical damage; or

(4) Enclosed by a metal or nonmetallic raceway or enclosure. The raceway or enclosure must be approved to protect from severe physical damage if it is not protected by appropriate physical barriers from contact with vehicles, lawn mowers, and other equipment that might damage the conductor or enclosure.

Informational Note: WAC 296-46B-250 064(5) has been incorporated into this section.

(3) **Smaller Than 6 AWG.** Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, Schedule 80 PVC, RTRC-XW, EMT, or cable armor.

(4) **In Contact with the Earth.** Grounding electrode conductors and grounding electrode bonding jumpers in contact with the earth shall not be required to comply with 300.5 or 305.15, but shall be buried or otherwise protected if subject to physical damage.

Informational Note: WAC 296-46B-250 064(5) has been incorporated into this section.

(C) Continuous. Except as provided in 250.30(A)(5) and (A)(6), 250.30(B)(1), and 250.68(C), grounding electrode conductor(s) shall be installed in one continuous length without a splice or joint. If necessary, splices or connections shall be made as permitted in the following:

(1) Splicing of the wire-type grounding electrode conductor shall be permitted only by irreversible compression-type connectors listed as grounding and bonding equipment or by the exothermic welding process.
(2) Sections of busbars shall be permitted to be connected together to form a grounding electrode conductor.
(3) Bolted, riveted, or welded connections of structural metal frames of buildings or structures.
(4) Threaded, welded, brazed, soldered or bolted-flange connections of metal water piping.

(D) Building or Structure with Multiple Disconnecting Means in Separate Enclosures. If a building or structure is supplied by a service or feeder with two or more disconnecting means in separate enclosures, the grounding electrode connections shall be made in accordance with 250.64(D)(1), (D)(2), or (D)(3).

(1) Common Grounding Electrode Conductor and Taps. A common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded conductor(s) of each set of conductors that supplies the disconnecting means. If the service-entrance conductors connect directly to the overhead service conductors, service drop, underground service conductors, or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, note 1.

A grounding electrode conductor tap shall extend to the inside of each disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance or feeder conductor serving the individual enclosure. The tap conductors shall be connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:

(1) Exothermic welding.

(2) Connectors listed as grounding and bonding equipment.

(3) Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1⁄4 in. thick × 2 in. wide) and of a length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. If aluminum busbars are used, the installation shall comply with 250.64(A).

The termination point of a grounding electrode conductor tap to the grounding electrode conductor must be accessible unless the connection is made using an exothermic or irreversible compression connection.

Informational Note: The requirements of WAC 296-46B-250 064(6) have been incorporated herein.

(2) Individual Grounding Electrode Conductors. A grounding electrode conductor shall be connected between the grounding electrode system and one or more of the following, as applicable:

(1) Grounded conductor in each service equipment disconnecting means enclosure

(2) Equipment grounding conductor installed with the feeder(s) or branch circuit(s) for other than services

(3) Supply-side bonding jumper

Each grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) supplying the individual disconnecting means.

(3) Common Location. A grounding electrode conductor shall be connected in a wireway or other accessible enclosure on the supply side of the disconnecting means to one or more of the following, as applicable:

(1) Grounded service conductor(s)

(2) Equipment grounding conductor installed with the feeder

(3) Supply-side bonding jumper

The connection shall be made with exothermic welding or a connector listed as grounding and bonding equipment. The grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) at the common location where the connection is made.

(E) Raceways, Cable Armor, and Enclosures for Grounding Electrode Conductors.

(1) General. Ferrous metal raceways, enclosures, and cable armor for grounding electrode conductors shall be electrically continuous from the point of attachment to cabinets or equipment to the grounding electrode and shall be securely fastened to the ground clamp or fitting. Ferrous metal raceways, enclosures, and cable armor shall be bonded at each end of the raceway or enclosure to the grounding electrode or grounding electrode conductor to create an electrically parallel path. Nonferrous metal raceways, enclosures, and cable armor shall not be required to be electrically continuous.
(2) Methods. Bonding shall be in compliance with 250.92(B) and ensured by one of the methods in 250.92(B)(2) through (B)(4).
(3) Size. The bonding jumper for a grounding electrode conductor(s), raceway(s), enclosure(s), or cable armor shall be the same size as, or larger than, the largest enclosed grounding electrode conductor.
(4) Wiring Methods. If a raceway is used as protection for a grounding electrode conductor, the installation shall comply with the requirements of the applicable raceway article.

(F) Installation to Electrode(s). Grounding electrode conductor(s) and bonding jumpers interconnecting grounding electrodes shall be installed in accordance with one of the following. The grounding electrode conductor shall be sized for the largest grounding electrodes shall be installed in accordance with one of the following. The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all the electrodes connected to it.

(1) The grounding electrode conductor shall be permitted to be run to any convenient grounding electrode available in the grounding electrode system where the other electrode(s), if any, is connected by bonding jumpers that are installed in accordance with 250.53(C).
(2) Grounding electrode conductor(s) shall be permitted to be run to one or more grounding electrode(s) individually.
(3) Bonding jumper(s) from grounding electrode(s) shall be permitted to be connected to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1⁄4 in. thick × 2 in wide.) and of sufficient length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. The grounding electrode conductor shall be permitted to be run to the busbar. Where aluminum busbars are used, the installation shall comply with 250.64(A).

N **(G) Enclosures with Ventilation Openings.** Grounding electrode conductors shall not be installed through a ventilation opening of an enclosure.

250.90 General. Bonding shall be provided where necessary to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.

Exception No. 1: Metallic stubs or valves used in nonmetallic plumbing systems are not required to be bonded to the electrical system unless required by an electrical equipment manufacturer's instructions.

Exception No. 2: Hot and cold water plumbing lines are not required to be bonded together if, at the time of inspection, the inspector can determine the lines are mechanically and electrically joined by one or more metallic mixing valves.

Informational Note: WAC 296-46B-250.090(7) and (8), requirements regarding bonding in plumbing systems or lines, are incorporated herein as Exceptions.

250.92 Services.

(A) Bonding of Equipment for Services. The normally non-current-carrying metal parts of equipment indicated in the following shall be bonded together:

(1) All raceways, including utility raceways that are electrically continuous to service equipment; cable trays((,)); cablebus framework; auxiliary gutters((,)); or service cable armor or sheath; that enclose, contain, or support service conductors, except as permitted in 250.80

(2) All enclosures containing service conductors, including meter fittings, boxes, or the like, interposed in the service raceway or armor

Δ **(B) Method of Bonding at the Service.** Bonding jumpers meeting the requirements of this article shall be used around impaired connections, such as reducing washers or oversized, concentric, or eccentric knockouts. Standard locknuts or bushings shall not be the only means for the bonding required by this section but shall be permitted to be installed to make a mechanical connection of the raceway(s).

Electrical continuity at service equipment, service raceways, and service conductor enclosures shall be ensured by one or more of the following methods:

(1) Bonding equipment to the grounded service conductor by an applicable method in 250.8(A). Connection to the grounded service conductor shall not be used to bond current transformer enclosures under jurisdiction of the utility.

Informational Note: This requirement originates from *Requirements for Electric Service Connection*, chapter 6, published by Seattle City Light, and is incorporated herein.

(2) Connections made up wrenchtight using threaded couplings, threaded entries, or listed threaded hubs on enclosures
(3) Threadless couplings and connectors if made up tight for metal raceways and metal-clad cables
(4) Other listed devices, such as bonding-type locknuts, bushings, or bushings with bonding jumpers

250.104 Bonding of Piping Systems and Exposed Structural Metal.

(A) Metal Water Piping. The metal water piping system shall be bonded as required in 250.104(A)(1), (A)(2), or (A)(3).

(1) General. Metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Grounding electrode conductor, if of sufficient size

(4) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size

The bonding jumper(s) shall be installed in accordance with 250.64(A), (B), and (E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1) except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum and except as permitted in 250.104(A)(2) and (A)(3).

(2) Buildings of Multiple Occupancy. In buildings of multiple occupancy where the metal water piping system(s) installed in or attached to a building or structure for the individual occupancies is metallically isolated from all other occupancies by use of nonmetallic water piping, the metal water piping system(s) for each occupancy shall be permitted to be bonded to the equipment grounding terminal of the switchgear, switchboard, or panelboard enclosure (other than service equipment) supplying that occupancy. The bonding jumper shall be sized in accordance with 250.102(D).

(3) Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s). The metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

(1) Building or structure disconnecting means enclosure where located at the building or structure

(2) Equipment grounding conductor run with the supply conductors

(3) One or more grounding electrodes used

The bonding jumper(s) shall be sized in accordance with 250.102(D). The bonding jumper shall not be required to be larger than the largest ungrounded feeder or branch-circuit conductor supplying the building or structure.

Informational Note: See 250.90 exception #1 for bonding of metallic stubs and valves used in non-metallic plumbing systems and 250.90 exception #2 for bonding of hot water lines.

(B) Flexible Metal Natural Gas Piping. Bonding of flexible metal natural gas piping installations, installed new or extended from an existing rigid metal piping system, shall comply with either 250.104(B)(1) or (2):

(1) Installed per manufacturer's instructions. A copy of the manufacturer's instructions shall be provided to the inspector at time of inspection.

(2) Bonded with a minimum 6 AWG copper conductor and terminate at an accessible location on rigid iron piping downstream of the gas utility meter. The bonding conductor shall connect the gas piping system to the service equipment enclosure, grounding electrode or grounding electrode conductor, or grounded conductor termination bussing or bar in the service equipment enclosure.

Informational note: The requirements of WAC 296-46B-250 104(B)(9) are incorporated herein with edits.

Δ **((~~B~~))** **(C)** **Other Metal Piping.** If installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

(1) Equipment grounding conductor for the circuit that is likely to energize the piping system

(2) Service equipment enclosure

(3) Grounded conductor at the service

(4) Grounding electrode conductor, if of sufficient size

(5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size

The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.122, and equipment grounding conductors shall be sized in accordance with Table 250.122 using the rating of the circuit that is likely to energize the piping system(s). The points of attachment of the bonding jumper(s) shall be accessible.

Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety.

Informational Note No. 2: See NFPA 54, National Fuel Gas Code, and NFPA 780, Standard for the Installation of Lightning Protection Systems, for information on gas piping systems.

(((~~C~~))) (D) Structural Metal. Exposed structural metal that is interconnected to form a metal building frame, is not intentionally grounded or bonded, and is likely to become energized shall be bonded to any of the following:

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Disconnecting means for buildings or structures supplied by a feeder or branch circuit

(4) Grounding electrode conductor, if not smaller than a conductor sized in accordance with Table 250.102(C)(1)

(5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is not smaller than a conductor sized in accordance with Table 250.102(C)(1)

The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1), except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum, and installed in accordance with 250.64(A), (B), and (E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A), Exception No. 2.

(((~~D~~))) (E) Separately Derived Systems. Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems in accordance with 250.104(D)(1) through (D)(3).

(1) Metal Water Piping System(s). The grounded conductor of each separately derived system shall be bonded to the nearest accessible point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum.

Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is used as the grounding electrode or grounding electrode conductor for the separately derived system and the connection to the water piping system is in the area served by the separately derived system.

Exception No. 2: A separate bonding jumper to the metal water piping system shall not be required if the metal in-ground support structure is used as a grounding electrode or the metal frame of a building or structure is used as the grounding electrode conductor for a separately derived system and is bonded to the metal water piping system in the area served by the separately derived system.

(2) Structural Metal. If exposed structural metal that is interconnected to form the building frame exists in the area served by the separately derived system, it shall be bonded to the grounded conductor of each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum.

Exception No. 1: A separate bonding jumper to the building structural metal shall not be required if the metal in-ground support structure is used as a grounding electrode or the metal frame of a building or structure is used as the grounding electrode conductor for the separately derived system.

Exception No. 2: A separate bonding jumper to the building structural metal shall not be required if the water piping system of a building or structure is used as the grounding electrode or grounding electrode conductor for a separately derived system and is bonded to the building structural metal in the area served by the separately derived system.

(3) Common Grounding Electrode Conductor. If a common grounding electrode conductor is installed for multiple separately derived systems as permitted by 250.30(A)(6), and exposed structural metal that is

interconnected to form the building frame or interior metal water piping exists in the area served by the separately derived system, the metal water piping and the structural metal member shall be bonded to the common grounding electrode conductor in the area served by the separately derived system.

Exception: A separate bonding jumper from each derived system to metal water piping and to structural metal members shall not be required if the metal water piping and the structural metal members in the area served by the separately derived system are bonded to the common grounding electrode conductor.

(F) Water system requirements. It is unlawful to connect to or use any water main or water pipe belonging to Seattle Public Utilities distribution and transmission systems for electrical grounding purposes.

Δ **250.118 Types of Equipment Grounding Conductors.**
N **(A) Permitted.** Each equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:
(1) A copper, aluminum, or copper-clad aluminum conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a busbar of any shape.

(2) Rigid metal conduit.

(3) Intermediate metal conduit.

(4) Electrical metallic tubing except in wet locations.

(5) Listed flexible metal conduit meeting all the following conditions:

a. The conduit is terminated in listed fittings.

b. The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

c. The size of the conduit does not exceed metric designator 35 (trade size 1¼).

d. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).

e. If flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.

f. If flexible metal conduit is constructed of stainless steel, a wire-type equipment grounding conductor or bonding jumper in accordance with 250.102(E)(2) shall be installed.

(6) Listed liquidtight flexible metal conduit meeting all the following conditions:

a. The conduit is terminated in listed fittings.

b. For metric designators 12 through 16 (trade sizes ⅜ through ½), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

c. For metric designators 21 through 35 (trade sizes ¾ through 1¼), the circuit conductors contained in the conduit are protected by overcurrent devices rated not more than 60 amperes and there is no flexible metal conduit, flexible metallic tubing, or liquidtight flexible metal conduit in metric designators 12 through 16 (trade sizes ⅜ through ½) in the effective ground-fault current path.

d. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).

e. If flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.

f. If liquidtight flexible metal conduit contains a stainless steel core, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.

(7) Flexible metallic tubing if the tubing is terminated in listed fittings and meeting the following conditions:

a. The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

b. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).

(8) Armor of Type AC cable as provided in 320.108.

(9) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(10) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

a. It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118(1).

b. The combined metallic sheath and uninsulated equipment grounding/bonding conductor of interlocked metal tape–type MC cable that is listed and identified as an equipment grounding conductor

c. The metallic sheath or the combined metallic sheath and equipment grounding conductors of the smooth or corrugated tube-type MC cable that is listed and identified as an equipment grounding conductor

(11) Cable trays as permitted in 392.10 and 392.60.

(12) Cablebus framework as permitted in 370.60(1).

(13) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(14) Surface metal raceways listed for grounding.

250.184 Solidly Grounded Neutral Systems.
Solidly grounded neutral systems shall be permitted to be either single point grounded or multigrounded neutral.

(A) Neutral Conductor.

(1) Insulation Level. The minimum insulation level for neutral conductors of solidly grounded systems shall be 600 volts.

Exception No. 1: For multigrounded neutral systems as permitted in 250.184(C), bare copper conductors shall be permitted to be used for the neutral conductor of the following:

(1) Service-entrance conductors

(2) Service laterals or underground service conductors

(3) Direct-buried portions of feeders

Exception No. 2: Bare conductors shall be permitted for the neutral conductor of overhead portions installed outdoors.

Exception No. 3: The grounded neutral conductor shall be permitted to be a bare conductor if isolated from phase conductors and protected from physical damage.

Informational Note: See 225.4 for conductor covering where within 3.0 m (10 ft) of any building or other structure.

(2) Ampacity. The neutral conductor shall have an ampacity that is not less than the load imposed and be not less than 33⅓ percent of the ampacity of the phase conductors.

Exception: In industrial and commercial premises under engineering supervision, it shall be permissible to size the ampacity of the neutral conductor to not less than 20 percent of the ampacity of the phase conductor.

(3) Existing installations. In addition to the requirements of NEC 250.184(A), the use of a concentric shield as a neutral conductor for extension, replacement, or repair in existing installations is permitted, if all of the following are complied with:

(1) The existing system uses the concentric shield as a neutral conductor;

(2) Each individual conductor contains a separate concentric shield sized to no less than thirty-three and one-third percent of the ampacity of the phase conductor for three phase systems or one hundred percent of the ampacity of the phase conductor for single-phase systems

(3) The new or replacement cable's concentric shield is enclosed inside an outer insulating jacket; and

(4) The existing cable (i.e., existing cable installed directly in the circuit between the work and the circuit's overcurrent device) successfully passes the following tests:

a. Cable maintenance high potential dielectric test. The test must be performed in accordance with the cable manufacturer's instruction or the most recently published ANSI/NETA maintenance test specifications; and
b. Resistance test of the cable shield. Resistance must be based on the type, size, and length of the conductor used as the cable shield using the conductor properties described in NEC Table 8 Conductor Properties.

An electrical engineer must provide a specific certification to the electrical plan review supervisor in writing that the test results of the maintenance high potential dielectric test and the resistance test have been reviewed by the electrical engineer and that the cable shield is appropriate for the installation. The electrical engineer must stamp the certification document with the engineer's stamp and signature. The document must be in the form of a letter or electrical plans.

Testing results are valid for a period of seven years from the date of testing. Cable must not be required to be tested at a shorter interval.

Informational Note: WAC 296-46B-250 (10) has been incorporated into this section.

Δ **(B) Single-Point Grounded Neutral System.** If a single-point grounded neutral system is used, the following shall apply:

(1) A single-point grounded neutral system shall be permitted to be supplied from one of the following:

a. A separately derived system
b. A multigrounded neutral system with an equipment grounding conductor connected to the multigrounded neutral conductor at the source of the single-point grounded neutral system

(2) A grounding electrode shall be provided for the system.

(3) A grounding electrode conductor shall connect the grounding electrode to the system neutral conductor.

(4) A bonding jumper shall connect the equipment grounding conductor to the grounding electrode conductor.

(5) An equipment grounding conductor shall be provided to each building, structure, and equipment enclosure.

(6) A neutral conductor shall only be required if phase-to-neutral loads are supplied.

(7) The neutral conductor, if provided, shall be insulated and isolated from earth except at one location.

(8) An equipment grounding conductor shall be run with the phase conductors and shall comply with all of the following:

a. Shall not carry continuous load

b. Shall be bare, covered, or insulated

c. Shall have ampacity for fault current duty

(C) Multigrounded Neutral Systems. If a multigrounded neutral system is used, the following shall apply:

(1) The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations:

a. Transformers supplying conductors to a building or other structure

b. Underground circuits if the neutral conductor is exposed

c. Overhead circuits installed outdoors

(2) The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode.

(3) At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft).

(4) The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft).

(5) In a multigrounded shielded cable system, the shielding shall be grounded at each cable joint that is exposed to personnel contact.

Exception: In a multipoint grounded system, a grounding electrode shall not be required to bond the neutral conductor in an uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode.

ARTICLE 300
General Requirements for Wiring Methods and Materials

300.1 Scope.

(A) All Wiring Installations. This article covers general requirements for wiring methods and materials for all wiring installations unless modified by other articles in Chapter 3.

Wiring methods in educational or institutional facilities as defined in this chapter must be metallic or nonmetallic raceways, MI, MC, or AC cable. Places of assembly located within these facilities must comply with NEC 518.4(A).

Exception: Assisted living facility generator systems may be wired and installed in accordance with Article 517, Health Care Facilities, of this Code.

Informational Note: WAC 296-46B-010(13), requirement for wiring method for assisted living facility generators, is incorporated herein with edits as an Exception.

(B) Integral Parts of Equipment. The requirements of this article are not intended to apply to the conductors that form an integral part of equipment, such as motors, controllers, motor control centers, or factory-assembled control equipment or listed utilization equipment.

(C) Metric Designators and Trade Sizes. Metric designators and trade sizes for conduit, tubing, and associated fittings and accessories shall be as designated in Table 300.1(C).

300.4 Protection Against Physical Damage.

Where subject to physical damage, conductors, raceways, and cables shall be protected.

(A) Cables and Raceways Through Wood Members.

Δ **(1) Bored Holes.** In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1 1/4 in.) from the edges of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (1/16 in.) thick, and of appropriate length and width installed to cover the area of the wiring. Where installed in exterior walls, all wiring and device boxes must be a minimum of 63 mm (2 1/2 in.) from the exterior wall surface of the framing member.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid PVC conduit, RTRC, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Exception No. 3: The installation of all structural elements and mechanical systems (e.g., framing, plumbing, ducting, etc.) must be complete in the area(s) where electrical inspection is requested. Prior to completion of an exterior wall cover inspection, either: (a) The exterior shear panel or sheathing nail inspection must be completed by the building inspector; or (b) All wiring and device boxes must be a minimum of 63 mm (2 1/2 in.) from the exterior surface of the framing member; or (c) All wiring and device boxes must be protected by a steel plate a minimum of 1.6 mm (1/16 in.) thick of appropriate width and height installed to cover the area of the wiring or box.

Informational Note: WAC 296-46B-010(6), requirements for protecting wiring in walls, are incorporated herein as Exception 3.

(2) Notches in Wood. Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected from penetration by nails or screws by a steel plate at least 1.6 mm (1/16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.

(5) **Nonmetallic-Sheathed Cable.**

a. In both exposed and concealed locations where nonmetallic-sheathed cables, operating at less than 120 volts nominal, pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, the cable shall be protected by listed bushings or listed grommets covering all metal edges that are securely fastened in the opening prior to installation of the cable.

b. Where nonmetallic-sheathed cables operate at 120 volts nominal or greater pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, listed two-piece interlocking bushings or grommets shall be installed prior to passing the cable through such openings.

(6) **Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.** Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing, a steel sleeve, steel plate, or steel clip not less than 1.6 mm (1/16 in.) in thickness shall be used to protect the cable or tubing.

Exception: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Δ **(C) Cables Through Spaces Behind Panels Designed to Allow Access.** Cables or raceway-type wiring methods, installed behind panels designed to allow access shall be supported according to their applicable articles.

(D) Cables and Raceways Parallel to Framing Members and Furring Strips. In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1 1/4 in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (1/16 in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Δ **(E) Cables, Raceways, or Boxes Installed in or Under Metal-Corrugated Roof Decking.** A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1 1/2 in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and might be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception No. 1: Rigid metal conduit and intermediate metal conduit, with listed steel or malleable iron fittings and boxes, shall not be required to comply with 300.4(E).

Exception No. 2: The 38 mm (1l/2in.) spacing is not required where metal-corrugated sheet roof decking is covered with a minimum thickness 50 mm (2 in.) concrete slab, measured from the top of the corrugated roofing.

(F) Cables and Raceways Installed in Shallow Grooves. Cable- or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1.6 mm (1/16 in.) thick steel plate, sleeve, or equivalent or by not less than 32-mm (1 1/4-in.) free space for the full length of the groove in which the cable or raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid PVC conduit, RTRC or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(G) Fittings. Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, prior to the installation of conductors, the conductors shall be protected in accordance with any of the following:
(1) An identified fitting providing a smoothly rounded insulating surface

(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

(H) Structural Joints. A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

300.5 Underground Installations.

(A) Minimum Cover Requirements. Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5(A).

(B) Wet Locations. The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall comply with 310.10(C).

(C) Underground Cables and Conductors Under Buildings. Underground cable and conductors installed under a building shall be in a raceway**.**

(D) Protection from Damage. Conductors and cables shall be protected from damage in accordance with 300.5(D)(1) through (D)(4).

(1) Emerging from Grade. Direct-buried conductors and cables emerging from grade and specified in Columns 1 and 4 of Table 300.5(A) shall be protected by enclosures or raceways extending from the minimum cover distance below grade required by 300.5(A) to a point at least 2.5 m (8 ft) above finished grade. In no case shall the protection be required to exceed 450 mm (18 in.) below finished grade.
(2) Conductors Entering Buildings. Conductors entering a building shall be protected to the point of entrance.

(3) Service Conductors. Underground service conductors that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.
(4) Enclosure or Raceway Damage. Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

(E) Splices and Taps. Direct-buried conductors or cables shall be permitted to be spliced or tapped without the use of splice boxes. The splices or taps shall be made in accordance with **110.14(B)**.

(F) Backfill. Backfill that contains large rocks, paving materials, cinders, large or sharply angular substances, or corrosive material shall not be placed in an excavation where materials might damage raceways, cables, conductors, or other substructures or prevent adequate compaction of fill or contribute to corrosion of raceways, cables, or other substructures.

Where necessary to prevent physical damage to the raceway, cable, or conductor, protection shall be provided in the form of granular or selected material, suitable running boards, suitable sleeves, or other approved means.

(G) Raceway Seals. Conduits or raceways through which moisture might contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

Informational Note: Presence of hazardous gases or vapors might also necessitate the sealing of underground conduits or raceways entering buildings.

(H) Bushing. A bushing, or terminal fitting, with an integral bushed opening shall be used at the end of a conduit or other raceway that terminates underground where the conductors or cables emerge as a direct burial wiring method. A seal incorporating the physical protection characteristics of a bushing shall be permitted to be used in lieu of a bushing.

(I) Conductors of the Same Circuit. All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors shall be installed in the same raceway or cable or shall be installed in close proximity in the same trench.

Exception No. 1: Conductors shall be permitted to be installed in parallel in raceways, multiconductor cables, or direct-buried single conductor cables. Each raceway or multiconductor cable shall contain all conductors of the same circuit, including equipment grounding conductors. Each direct-buried single conductor cable shall be located in close proximity in the trench to the other single conductor cables in the same parallel set of conductors in the circuit, including equipment grounding conductors.

Exception No. 2: Isolated phase, polarity, grounded conductor, and equipment grounding and bonding conductor installations shall be permitted in nonmetallic raceways or cables with a nonmetallic covering or nonmagnetic sheath in close proximity where conductors are paralleled as permitted in 310.10(G), and where the conditions of 300.20(B) are met.

(J) Earth Movement. Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, direct-buried conductors, raceways, or cables shall be arranged so as to prevent damage to the enclosed conductors or to equipment connected to the raceways.

Informational Note: This section recognizes “S” loops in underground direct burial cables and conductors to raceway transitions, expansion fittings in raceway risers to fixed equipment, and, generally, the provision of flexible connections to equipment subject to settlement or frost heaves.

(K) Directional Boring. Cables or raceways installed using directional boring equipment shall be approved for the purpose.

Table 300.5(A) Minimum Cover Requirements, 0 to 1000 Volts ac, 1500 Volts dc, Nominal, Burial in Millimeters (Inches)

Notes:
1. Cover shall be defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.
2. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.
3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.
5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

((~~6. Directly buried electrical metallic tubing (EMT) shall comply with 358.10.~~))

300.11 Securing and Supporting.
(A) Secured in Place. Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place.

Δ **(B) Wiring Systems Installed Above Suspended Ceilings.**
Support wires that do not provide secure support shall not be the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

(1) Fire-Rated Assemblies. Wiring located within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.

Informational Note: See ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, for one method of testing to determine fire rating.

(2) Non-Fire-Rated Assemblies. Wiring located within the cavity of a non-fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

Exception: The ceiling support system shall be permitted to support branch-circuit wiring and associated equipment where installed in accordance with the ceiling system manufacturer's instructions.

(3) <u>Suspended Ceilings.</u>

<u>(a) NEC power limited, Class 2, and Class 3 cables must be secured in compliance with section 334.30 and must be secured to boxes in compliance with section 314.17 of this Code.</u>

<u>(b) Telecommunications cables must be secured in a manner that will not cause damage to the cables and at intervals not exceeding five feet. Cables are considered adequately supported when run through holes in building structural elements or other supporting elements. Telecommunications cables may be fished into inaccessible hollow spaces of finished buildings. Clamps or fittings are not required where telecommunications cables enter boxes.</u>

(c) Optical fiber cables must be secured in a manner that will not cause damage to the cables and at intervals not exceeding five feet. Cables are considered adequately supported when run through holes in building structural elements or other supporting elements. Optical fiber cables may be fished into inaccessible hollow spaces of finished buildings. Supports must allow a bending radius that will not cause damage to the cables.

(d) Where not restricted by the building code official or Article 300 of this Code, the wires required in Section 300.11(A) of this Code may support raceways, cables, or boxes under the following conditions:

(1) Raceways or cables are not larger than three-quarter-inch trade size;

(2) No more than two raceways or cables are supported by a support wire. The two-cable limitation does not apply to telecommunications cables, Class 2 cables, or Class 3 cables on support wires installed exclusively for such cables. The support wire must be adequate to carry the cable(s) weight and all attached cables must be secured with approved fittings; or

(3) Raceways and cables are secured to the support wires by fittings designed and manufactured for the purpose. In addition to (1), (2), and (3) of this subsection, the following conditions must be complied with:

a. The support wires are minimum #12 AWG and are securely fastened to the structural ceiling and to the ceiling grid system; and

b. The raceways or cables serve equipment that is located within the ceiling cavity or is mounted on or supported by the ceiling grid system. Telecommunications cables, Class 2 cables, or Class 3 cables supported as required by this section, may pass through ceiling cavities without serving equipment mounted on or supported by the ceiling grid system.

Informational Note: WAC 296-46B-300.011 requirements for support of raceways, cables, or boxes in suspended ceilings is incorporated herein.

(C) Raceways Used as Means of Support.
Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:

(1) Where the raceway or means of support is identified as a means of support

(2) Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 or Class 3 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits

(3) Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

(D) Cables Not Used as Means of Support.
Cable wiring methods shall not be used as a means of support for other cables, raceways, or nonelectrical equipment.

300.15 Boxes, Conduit Bodies, or Fittings — Where Required. A box shall be installed at each outlet, non-soldered splice point, and switch point for concealed knob-and-tube wiring.

Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed.

Where the wiring method is conduit, tubing, Type AC cable, Type MC cable, Type MI cable, nonmetallic-sheathed cable, or other cables, a box or conduit body shall be installed at each outlet point, switch point, conductor splice

point, conductor junction point, conductor termination point, wiring method transition point, or conductor pull point, unless otherwise permitted in 300.15(A) through (L).

(A) Wiring Methods with Interior Access. A box or conduit body shall not be required for each splice, junction, switch, pull, termination, or outlet points in wiring methods with removable covers, such as wireways, multioutlet assemblies, auxiliary gutters, and surface raceways. The covers shall be accessible after installation.

(B) Equipment. An integral junction box or wiring compartment as part of approved equipment shall be permitted in lieu of a box.

(C) Protection. A box or conduit body shall not be required where cables enter or exit from conduit or tubing that is used to provide cable support or protection against physical damage. A fitting shall be provided on the end(s) of the conduit or tubing to protect the cable from abrasion.

(D) Type MI Cable. A box or conduit body shall not be required where accessible fittings are used for straight-through splices in mineral-insulated metal-sheathed cable.

(E) Integral Enclosure. A wiring device with integral enclosure identified for the use, having brackets that securely fasten the device to walls or ceilings of conventional on-site frame construction, for use with nonmetallic-sheathed cable, shall be permitted in lieu of a box or conduit body.

Informational Note: See 334.30(C); 545.10; 550.15(I); 551.47(E), Exception No. 1; and 552.48(E), Exception No. 1.

(F) Fitting. A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, unless listed for concealed installation.

(G) Direct-Buried Conductors and Cables. As permitted in 300.5(E), a box or conduit body shall not be required for splices and taps in direct-buried conductors and cables.

(**H) Insulated Devices**. As permitted in 334.40(B), a box or conduit body shall not be required for insulated devices supplied by nonmetallic-sheathed cable.

(I) Enclosures. A box or conduit body shall not be required where a splice, switch, terminal, or pull point is in a cabinet or cutout box, in an enclosure for a switch or overcurrent device as permitted in 312.8, in a motor controller as permitted in 430.10(A), or in a motor control center.

(J) Luminaires. A box or conduit body shall not be required where a luminaire is used as a raceway as permitted in 410.64.

(K) Embedded. A box or conduit body shall not be required for splices where conductors are embedded as permitted in 424.40, 424.41(D), 426.22(C), 426.24(A), and 427.19(A).

Δ **(L) Manholes and Handhole Enclosures**. A box or conduit body shall not be required for conductors in manholes or handhole enclosures, except where connecting to electrical equipment. The installation shall comply with Part V of Article 110 for manholes, and 314.30 for handhole enclosures.

300.19 Supporting Conductors and Cable Assemblies in Vertical ((~~Raceways~~)) Installations.

(A) Spacing Intervals — Maximum. Conductors and cables in vertical ((~~raceways~~)) installations shall be supported if the vertical rise exceeds the values in Table 300.19(A). At least one support method shall be provided for each conductor at the top of the vertical ((~~raceway~~)) installation or as close to the top as practical. Intermediate supports shall be provided as necessary to limit supported ((~~conductor~~)) lengths to not greater than those values specified in Table 300.19(A).

Exception: Steel wire armor cable shall be supported at the top of the riser with a cable support that clamps the steel wire armor. A safety device shall be permitted at the lower end of the riser to hold the cable in the event there is slippage of the cable in the wire-armored cable support. Additional wedge-type supports shall be permitted to relieve the strain on the equipment terminals caused by expansion of the cable under load.

(B) Fire-Resistive Cables and Conductors. Support methods and spacing intervals for fire-resistive cables and conductors shall comply with any restrictions provided in the listing of the electrical circuit protective system or fire-resistive cable system used and in no case shall exceed the values in Table 300.19(A).

(C) Support Methods. One of the following methods of support shall be used:

(1) Clamping devices constructed of or employing insulating wedges inserted in the ends of the raceways. Where clamping of insulation does not adequately support the cable, the conductor also shall be clamped.

(2) Inserting boxes at the required intervals in which insulating supports are installed and secured in an approved manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

(3) In junction boxes, deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, with the cables being carried on two or more insulating supports and additionally secured thereto by tie wires, if desired. Where this method is used, cables shall be supported at intervals not greater than 20 percent of the support spacing in Table 300.19(A).

(4) Other approved means.

300.21 Spread of Fire or Products of Combustion. Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations into or through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating. All out-of-service cable shall be removed from accessible ceiling spaces

Informational Note No. 1: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire-resistance-rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with the requirements of 300.21 can be found in building codes, fire resistance directories, and product listings.

Informational Note No. 2: See also Chapter 9 of the Seattle Building Code for fire protection systems and protection of penetrations of those systems

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

Δ **314.23 Supports.** Enclosures within the scope of this article shall be supported in accordance with 314.23(A) through (H) as applicable.

Δ **(A) Surface Mounting**. An enclosure mounted on a building or other surface shall be rigidly and securely fastened in place. If the surface does not provide rigid and secure support, additional support in accordance with this section shall be provided.

(B) Structural Mounting. An enclosure supported from a structural member or from grade shall be rigidly supported either directly or by using a metal, polymeric, or wood brace.

(1) Nails and Screws. Nails and screws, where used as a fastening means, shall secure boxes by using brackets on the outside of the enclosure, or by using mounting holes in the back or in one or more sides of the enclosure, or they shall pass through the interior within 6 mm (1⁄4 in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation. Mounting holes made in the field shall be approved.

(2) Braces. Metal braces shall be protected against corrosion and formed from metal that is not less than 0.51 mm (0.020 in.) thick uncoated. Wood braces shall have a cross section not less than nominal 25 mm × 50 mm (1 in. × 2 in.). Wood braces in wet locations shall be treated for the conditions. Polymeric braces shall be identified as being suitable for the use.

(C) Mounting in Finished Surfaces. An enclosure mounted in a finished surface shall be rigidly secured thereto by clamps, anchors, or fittings identified for the application.

(D) Suspended Ceilings. An enclosure mounted to structural or supporting elements of a suspended ceiling shall be not more than 1650 cm3 (100 in.3) in size and shall be securely fastened in place in accordance with either 314.23(D)(1) or (D)(2).

(1) Framing Members. An enclosure shall be fastened to the framing members by mechanical means such as bolts, screws, or rivets, or by the use of clips or other securing means identified for use with the type of ceiling framing member(s) and enclosure(s) employed. The framing members shall be supported in an approved manner and securely fastened to each other and to the building structure.

(2) Support Wires. The installation shall comply with 300.11(B). The enclosure shall be secured, using identified methods, to ceiling support wire(s), including any additional support wire(s) installed for ceiling support. Support wire(s) used for enclosure support shall be fastened at each end so as to be taut within the ceiling cavity.

Δ **(E) Raceway-Supported Enclosure, Without Devices, Luminaires, or Lampholders.** An enclosure that does not contain a device(s), other than splicing devices, or supports a luminaire(s), a lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm3 (100 in.3) in size. It shall have threaded entries or identified hubs. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 900 mm (3 ft) of the enclosure, or within 450 mm (18 in.) of the enclosure if all conduit entries are on the same side.

Exception: The following wiring methods shall be permitted to support a conduit body of any size, including a conduit body constructed with only one conduit entry, provided that the trade size of the conduit body is not larger than the largest trade size of the conduit or tubing:
(1) Intermediate metal conduit, IMC

(2) Rigid metal conduit, RMC

(3) Rigid polyvinyl chloride conduit, PVC

(4) Reinforced thermosetting resin conduit, RTRC

(5) Electrical metallic tubing, EMT

(F) Raceway-Supported Enclosures, with Devices, Luminaires, or Lampholders. An enclosure that contains a device(s), other than splicing devices, or supports a luminaire(s), a lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm3 (100 in.3) in size. It shall have threaded entries or identified hubs. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 450 mm (18 in.) of the enclosure.

Exception No. 1: Rigid metal or intermediate metal conduit shall be permitted to support a conduit body of any size, including a conduit body constructed with only one conduit entry, provided the trade size of the conduit body is not larger than the largest trade size of the conduit.

Exception No. 2: An unbroken length(s) of rigid or intermediate metal conduit shall be permitted to support a box used for luminaire or lampholder support, or to support a wiring enclosure that is an integral part of a luminaire and used in lieu of a box in accordance with 300.15(B), where all of the following conditions are met:
(1) The conduit is securely fastened at a point so that the length of conduit beyond the last point of conduit support does not exceed 900 mm (3 ft).

(2) The unbroken conduit length before the last point of conduit support is 300 mm (12 in.) or greater, and that portion of the conduit is securely fastened at some point not less than 300 mm (12 in.) from its last point of support.

(3) *Where accessible to unqualified persons, the luminaire or lampholder, measured to its lowest point, is at least 2.5 m (8 ft) above grade or standing area and at least 900 mm (3 ft) measured horizontally to the 2.5 m (8 ft) elevation from windows, doors, porches, fire escapes, or similar locations.*

(4) A luminaire supported by a single conduit does not exceed 300 mm (12 in.) in any direction from the point of conduit entry.

(5) The weight supported by any single conduit does not exceed 9 kg (20 lb).

(6) At the luminaire or lampholder end, the conduit(s) is threaded wrenchtight into the box, conduit body, integral wiring enclosure, or identified hubs. Where a box or conduit body is used for support, the luminaire shall be secured directly to the box or conduit body, or through a threaded conduit nipple not over 75 mm (3 in.) long.

(G) Enclosures in Concrete or Masonry. An enclosure supported by embedment shall be identified as suitably protected from corrosion and securely embedded in concrete or masonry.

(H) Pendant Boxes. An enclosure supported by a pendant shall comply with 314.23(H)(1) or (H)(2).

(1) Flexible Cord. A box shall be supported from a multiconductor cord or cable in an approved manner that protects the conductors against strain. A connection to a box equipped with a hub shall be made with a listed cord grip attachment fitting marked for use with a threaded hub.

Flexible cord and cord connections must comply with 314.23(H) of this Code and the following:

a. A suspended pendant box must not contain conduit “knockouts” and connection to a suspended box must utilize an integral threaded hub;

b. The maximum length of the cord for a suspended pendant drop from a permanently installed junction box to a suitable tension take-up device above the pendant box must not exceed six feet;

c. The flexible cord must be supported at each end with an approved cord grip or strain relief connector fitting/device that will eliminate all stress on the conductor connections;

d. The flexible cord must be a minimum No. 14 AWG copper;

e. The flexible cord ampacity must be determined using NEC Table 400.5(A) column A; and

f. The flexible cord must be hard or extra hard usage.

Informational Note: WAC 296-46B-314-023(H), requirements for flexible cord connection of pendant boxes, is incorporated herein.

(2) Conduit. A box supporting lampholders or luminaires, or wiring enclosures within luminaires used in lieu of boxes in accordance with 300.15(B), shall be supported by rigid or intermediate metal conduit stems. For stems longer than 450 mm (18 in.), the stems shall be connected to the wiring system with listed swivel hangers suitable for the location. At the luminaire end, the conduit(s) shall be threaded wrenchtight into the box, wiring enclosure, or identified hubs.

Where supported by only a single conduit, the threaded joints shall be prevented from loosening by the use of set-screws or other effective means, or the luminaire, at any point, shall be at least 2.5 m (8 ft) above grade or standing area and at least 900 mm (3 ft) measured horizontally to the 2.5 m (8 ft) elevation from windows, doors, porches, fire escapes, or similar locations. A luminaire supported by a single conduit shall not exceed 300 mm (12 in.) in any horizontal direction from the point of conduit entry.

ARTICLE 326
Integrated Gas Spacer Cable: Type IGS

326.10 Uses Permitted. Type IGS cable shall be permitted for use underground, including direct burial in the earth, as the following:

(1) ((~~Service-entrance conductors~~)) Reserved
(2) Feeder or branch-circuit conductors
(3) ((~~Service conductors, underground~~)) Reserved

ARTICLE 330
Metal-Clad Cable: Type MC

330.10 Uses Permitted.
(A) General Uses. Type MC cable shall be permitted as follows:
(1) For ((~~services,~~)) feeders, and branch circuits.

(2) For power, lighting, control, and signal circuits.

(3) Indoors or outdoors.

(4) Exposed or concealed.

(5) To be direct buried where identified for such use.

(6) In cable tray where identified for such use.

(7) In any raceway.

(8) As aerial cable on a messenger.

(9) In hazardous (classified) locations where specifically permitted by other articles in this Code.

(10) In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.

(11) In damp or wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:

a. The metallic covering is impervious to moisture.

b. A jacket resistant to moisture is provided under the metal covering.

c. The insulated conductors under the metallic covering are listed for use in wet locations.

(12) Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

(B) Specific Uses. Type MC cable shall be permitted to be installed in compliance with Parts II and III of Article 725 and 770.133 as applicable and in accordance with 330.10(B)(1) through (B)(4).

Informational Note: The "Uses Permitted" is not an all-inclusive list.

(1) Cable Tray. Type MC cable installed in cable tray shall comply with 392.10, 392.12, 392.18, 392.20, 392.22, 392.30, 392.46, 392.56, 392.60(C), and 392.80.

(2) Direct Buried. Direct-buried cable shall comply with 300.5 or 305.15, as appropriate.

**(3)((~~Installed as Service-Entrance Cable~~. ~~Type MC cable installed as service-entrance cable shall be permitted in accordance with 230.43.~~))-Not adopted.

(4) Installed Outside of Buildings or Structures or as Aerial Cable. Type MC cable installed outside of buildings or structures or as aerial cable shall comply with 225.10, 396.10, and 396.12.

ARTICLE 334
Nonmetallic-Sheathed Cable: Types NM and NMC

334.10 Uses Permitted. Type NM and Type NMC cables shall be permitted to be used in the following, except as prohibited in 334.12:

(1) One- and two-family dwellings and their attached or detached garages, and their storage buildings.

(2) Multi-family dwellings and their detached garages permitted to be of Types III, IV, and V construction. Cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

(3) Other structures permitted to be of Types III, IV((~~-HT~~)), and V construction. Cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

Informational Note No. 1: See NFPA 220-2021, *Standard on Types of Building Construction*, or the applicable building code, or both for types of building construction and occupancy classification definitions.

Informational Note No. 2: See Informative Annex E for determination of building types.

(4) Cable trays in structures permitted to be Types III, IV, or V where the cables are identified for the use.

Informational Note No. 3: See 310.14(A)(3) for temperature limitation of conductors.

(5) Types I and II construction where installed within raceways permitted to be installed in Types I and II construction.

(A) Type NM. Type NM cable shall be permitted as follows:

(1) For both exposed and concealed work in normally dry locations except as prohibited in 334.10(3)

(2) To be installed or fished in air voids in masonry block or tile walls

(B) Type NMC. Type NMC cable shall be permitted as follows:

(1) For ((~~both exposed and~~)) concealed work in dry, wet, damp, or corrosive locations, except as prohibited by 334.10(3)

(2) In outside and inside walls of masonry block or tile

(3) In a shallow chase in masonry, concrete, or adobe protected against nails or screws by a steel plate at least 1.59 mm (1⁄16 in.) thick and covered with plaster, adobe, or similar finish

334.12 Uses Not Permitted.
(A) Types NM and NMC. Types NM and NMC cables shall not be permitted as follows:

(1) In any dwelling or structure not specifically permitted in 334.10(1), (2), (3), and (5)

(2) Exposed within a dropped or suspended ceiling cavity in other than one- and two-family and multifamily dwellings

(3) As service-entrance cable

(4) In commercial garages having hazardous (classified) locations as defined in 511.3

(5) In theaters and similar locations, except where permitted in 518.4(C)

(6) In motion picture studios

(7) In storage battery rooms

(8) In hoistways or on elevators or escalators

(9) Embedded in poured cement, concrete, or aggregate

(10) In hazardous (classified) locations, except where specifically permitted by other articles in this *Code*

(11) High-rise building(s) as defined in Chapter 2 of the Seattle Building Code

(B) Type NM. Type NM cables shall not be used under the following conditions or in the following locations:

(1) Where exposed to corrosive fumes or vapors

(2) Where embedded in masonry, concrete, adobe, fill, or plaster

(3) In a shallow chase in masonry, concrete, or adobe and covered with plaster, adobe, or similar finish

(4) In wet or damp locations

Exception to (4): Wet or damp locations do not include the interior of conduits installed in wet locations outdoors used for physical protection of NM cables under the following conditions:

(a) Cables emerging from a building interior, attic, or crawlspace remain unbroken until terminated; and

(b) Flexible metal conduits are not used; and

(c) No conduit systems are longer than 10 ft or any portion is below grade; and

(d)Conduits are sealed to prevent air movement and are arranged to naturally drain

334.15 Exposed Work.((~~In exposed work,~~)) NM cable shall not be exposed except as ((~~provided in 300.11(B), cable shall be installed as specified in 334.15(A) through (C)~~)) allowed in 334.15(B) through (D) and 334.23.

Nonmetallic-sheathed cable shall be considered as concealed where installed in inaccessible void areas of buildings or where run between or through studs, joists and similar members as required in Section 300.4. All outlet, junction, or device boxes shall be installed as required for concealed work.

Exception: Exposed nonmetallic-sheathed cable that is properly supported may enter the top section only of a surface- mounted panelboard and cabinet where the distance from the top of the panel enclosure to the bottom of the ceiling joist above does not exceed 30 in.

(((~~(A) To Follow Surface.~~ ~~Cable shall closely follow the surface of the building finish or of running boards~~.))

Δ **(B) Protection from Physical Damage**. Where exposed, cable shall be protected from physical damage ((~~where necessary~~)) by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, ((~~Schedule 80~~)) PVC conduit, RTRC marked with the suffix -XW, or other approved means. ((~~Where passing through a floor, the cable shall be enclosed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC conduit, RTRC marked with the suffix -XW, or other approved means extending at least 150 mm (6 in.) above the floor~~.)) Conduit or tubing shall be provided with a bushing or adapter that provides protection from abrasion at the point the cable enters and exits the raceway.

Type NMC cable installed in shallow chases or grooves in masonry, concrete, or adobe shall be protected in accordance with the requirements in 300.4(F) and covered with plaster, adobe, or similar finish.

Δ **(C) In Unfinished Basements, ((~~and Crawl Spaces.~~))** Where cable is run at angles with joists in unfinished basements ((~~and crawl spaces,~~)) it shall be ((~~permissible to secure cables not smaller than two 6 AWG or three 8 AWG conductors directly to the lower edges of the joists. Smaller cables shall be~~)) run ((~~either~~)) through bored holes in joists. ((~~or on running boards.~~)) Nonmetallic-sheathed cable installed on the wall of an unfinished basement shall be ((~~permitted to be~~)) installed in a listed conduit or tubing. ((~~or shall be protected in accordance with 300.4.~~)) Conduit or tubing shall be provided with a bushing or adapter that provides protection from abrasion at the point the cable enters and exits the raceway. The sheath of the nonmetallic-sheathed cable shall extend through the conduit or tubing and into the outlet, device, or junction box not less than 6 mm (1⁄4 in.). The cable shall be secured within 300 mm (12 in.) of the point where the cable enters the conduit or tubing. Metal conduit, tubing, and metal outlet boxes shall be connected to an equipment grounding conductor complying with 250.86 and 250.148.

(D) In Crawl Spaces. Where cable is run at angles with joists in crawl spaces, it shall be permissible to secure cables directly to the lower edges of the joists or through bored holes in the joists.

334.25 Out of service and abandoned conductors. All out-of-service cable and abandoned conductors shall be removed from accessible ceiling and wall spaces unless tagged and terminated at both ends in accordance with 300.15.

ARTICLE 336
Power and Control Cable: Type TC

336.10 Uses Permitted. Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.

(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).

(3) In raceways.

(4) In outdoor locations supported by a messenger wire.

(5) For Class 1 circuits as permitted in Parts II and III of Article 725.

(6) For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.

(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:

a. The cable is Type TC-ER.

b. The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.

c. The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.

d. The cable complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC–ER."

e. The cable is secured at intervals not exceeding 1.8 m (6 ft).

f. Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor shall be provided within the cable or, at the time of installation, one or more insulated conductors shall be permanently identified as an equipment grounding conductor in accordance with 250.119(C).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(8) Type TC cable shall be resistant to moisture and corrosive agents where installed in wet locations.

(9) For one- and two-family dwelling units, Type TC-ER-JP cable containing conductors for both power and control circuits shall be permitted for branch circuits and feeders. Type TC-ER-JP cable used as interior wiring shall be installed per the requirements of Part II of Article 334 and where installed as exterior wiring shall be installed per the requirements of Part II of Article 340.

Exception: Where used to connect a generator and associated equipment having terminals rated 75°C (140°F) or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.

Informational Note No. 1: See 725.136 for limitations on Class 2 or 3 circuits contained within the same cable with conductors of electric light, power, or Class 1 circuits.

(10) Direct buried, where identified for such use.

(11) In hazardous (classified) locations where specifically permitted by other articles in this Code.

(12) ((~~For service-entrance conductors where identified for such use and marked Type TC-ER.~~)) Reserved.

(13) In addition to the uses allowed in NEC 336.10, Type TC-ER-JP cable may be used in any location allowed for nonmetallic sheathed cable in NEC 334 if all the installation requirements in NEC 336 and 334 and WAC 296-46B-334 are met.

Informational Note No. 2: See 310.14(A)(3) for temperature limitation of conductors.

Informational Note No. 3: WAC 296-46B-336.010 is incorporated herein.

ARTICLE 338
Service Entrance Cables: Types SE and USE

338.10 Uses Permitted.

(A) ((~~Service-Entrance Conductors.~~ ~~Service-entrance cable shall be permitted to be used as service-entrance conductors and shall be installed in accordance with 230.6, 230.7, and Parts II, III, and IV of Article 230~~.))
Reserved.

(B) Branch Circuits or Feeders.

(1) Grounded Conductor Insulated. Type SE service-entrance cables shall be permitted in wiring systems where all of the circuit conductors of the cable are of the thermoset or thermoplastic type.

(2) Use of Uninsulated Conductor. Type SE service-entrance cable shall be permitted for use where the insulated conductors are used for circuit wiring and the uninsulated conductor is used only for equipment grounding purposes.

Exception: In existing installations, uninsulated conductors shall be permitted as a grounded conductor in accordance with 250.32 and 250.140, where the uninsulated grounded conductor of the cable originates in service equipment, and with 225.30 through 225.40.

(3) Temperature Limitations. Type SE service-entrance cable used to supply appliances shall not be subject to conductor temperatures in excess of the temperature specified for the type of insulation involved.

(4) Installation Methods for Branch Circuits and Feeders.

(a) *Interior Installations.* Interior installations shall comply with the following:

(1) In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80.

(2) Where more than two Type SE cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

(3) For Type SE cable with ungrounded conductor sizes 10 AWG and smaller, where installed in contact with thermal insulation, the ampacity shall be in accordance with 60°C (140°F) conductor temperature rating. The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes, if the final ampacity does not exceed that for a 60°C (140°F) rated conductor.

(b) *Exterior Installations.* Exterior installations shall comply with the following:

(1) In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30.
(2) Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340.

Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340

Δ 338.12 Uses Not Permitted.

(A) Service-Entrance Cable. Type SE cable shall not be used under the following conditions or in the following locations:

(1) Where subject to physical damage unless protected in accordance with 230.50(B)

(2) Underground with or without a raceway

(3) For exterior branch circuits and feeder wiring unless the installation complies with Part I of Article 225 and is supported in accordance with 334.30 or is used as messenger-supported wiring as permitted in Part II of Article 396

(4) As service entrance conductors

(B) Underground Service-Entrance Cable. Type USE cable shall not be used under the following conditions or in the following locations:

(1) For interior wiring

(2) For aboveground installations except where USE cable emerges from the ground and is terminated in an enclosure at an outdoor location and the cable is protected in accordance with 300.5(D)

(3) As aerial cable unless it is a multiconductor cable identified for use aboveground and installed as messenger-supported wiring in accordance with 225.10 and Part II of Article 396

(4) As service entrance conductor

338.25 Out of service and abandoned conductors. All out-of-service cable and abandoned conductors shall be removed from accessible ceiling and wall spaces unless tagged and terminated at both ends in accordance with 300.15.

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.10 Uses Permitted.

(A) Exposed and Concealed. The use of EMT shall be permitted for both exposed and concealed work for the following:

(1) In concrete((,)) not in direct contact with the earth((~~, in direct burial applications with fittings identified for direct burial, or in areas subject to severe corrosive influences where installed in accordance with 358.10(B).~~))

(2) In dry, damp, and wet locations

(3) In any hazardous (classified) location as permitted by other articles in this Code

(4) For manufactured wiring systems as permitted in 604.100(A)(2)

(B) Corrosive Environments.

(1) Galvanized Steel and Stainless Steel EMT, Elbows, and Fittings. Galvanized steel and stainless steel EMT, elbows, and fittings shall be permitted to be installed in concrete((,)) that is not in direct contact with the earth, or in areas subject to ((~~severe~~)) corrosive influences where protected by corrosion protection and approved as suitable for the condition.

(2) Supplementary Protection of Aluminum EMT. Aluminum EMT shall be provided with approved supplementary corrosion protection where encased in concrete or in direct contact with the earth.

(((~~**(C) Cinder Fill.** Galvanized steel and stainless steel EMT shall be permitted to be installed in cinder concrete or cinder fill where subject to permanent moisture when protected on all sides by a layer of noncinder concrete at least 50 mm (2 in.) thick or when the tubing is installed at least 450 mm (18 in.) under the fill.~~))

(D) Wet Locations. All supports, bolts, straps, screws, and so forth shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials.

Circuits installed in EMT in wet locations shall use equipment grounding conductors sized in accordance with Section 250.122.

Informational Note No. 1: See 300.6 for protection against corrosion.
Informational Note No. 2: The requirements of 296-46B-358-012(2) ARE INCORPORATED HEREIN.

(E) Physical Damage. Steel and stainless steel EMT shall be permitted to be installed where subject to physical damage.

358.12 Uses Not Permitted. EMT shall not be used under the following conditions:

(1) Where, during installation or afterward, it will be subject to severe physical damage

(2) For the support of luminaires or other equipment except conduit bodies no larger than the largest trade size of the tubing

(3) Where protected from corrosion solely by enamel.

(4) Where placed in concrete and the concrete is in direct contact with the earth.

ARTICLE 382
Nonmetallic Extensions

Article 382, Nonmetallic Extensions, is not adopted.

ARTICLE 394
Concealed Knob-and-Tube Wiring

394.1 Scope. This article covers the use, installation, and construction specifications of concealed knob-and-tube wiring.

This article does not prohibit the installation of loose or rolled thermal insulating material in spaces containing existing knob-and-tube wiring provided that all the following conditions are met:

(1) The wiring must be surveyed by an appropriately licensed electrical contractor who must certify in writing to the department that the wiring is in good condition with no evidence of improper overcurrent protection, conductor insulation failure or deterioration, and with no improper connections or splices. The electrical inspector must inspect all repairs, alterations, or extensions to the electrical system.

(2) The insulation must meet Class I specifications as identified in the International Building Code, with a flame spread index of 25 or less as tested using ASTM E84 or UL 723. Foam insulation may not be used with knob-and-tube wiring.

(3) All knob-and-tube circuits must have overcurrent protection in compliance with NEC Table 310.16, 60 degrees centigrade, Column C. Overcurrent protection must be either circuit breakers or Type S fuses.

Informational Note: WAC 296-46B-394, requiring a survey of the condition of the knob and tube wiring in an attic prior to insulating attic, is incorporated herein.

(4) Any energized knob and tube wiring that has been abandoned or serves no purpose must be removed or terminated per 110.14(B).

Part II. Installation

394.10 Uses Permitted. Concealed knob-and-tube wiring shall be permitted to be installed in the hollow spaces of walls and ceilings, or in unfinished attics and roof spaces ((~~as provided by 394.23, only as follows:~~)) when approved by the authority having jurisdiction.

(((~~(1) For extensions of existing installations~~

~~(2) Elsewhere by special permission~~))

394.25 Out of service and abandoned conductors. All out-of-service cable and abandoned conductors shall be removed from accessible ceiling and wall spaces unless tagged and terminated at both ends in accordance with SEC 300.15.

394.56 Splices and Taps. Splices shall be soldered unless approved splicing devices are used. In-line or strain splices shall not be used.

Informational Note: See 300.15 of the Seattle Electrical Code for box requirements relating to non-soldered splices.

ARTICLE 398
Open Wiring on Insulators

Article 398, Open Wiring on Insulators, is not adopted.

ARTICLE 404
Switches

404.3 Enclosure.

(A) General. Switches and circuit breakers shall be of the externally operable type mounted in an enclosure listed for the intended use. The minimum wire-bending space at terminals and minimum gutter space provided in switch enclosures shall be as required in 312.6.

~~*((Exception No. 1: Pendant- and surface-type snap switches and knife switches mounted on an open-face switchboard or panelboard shall be permitted without enclosures.*~~

~~*Exception No. 2: Switches and circuit breakers installed in accordance with* **110.27(A)(1)**, *(A)(2), (A)(3), or (A)(4) shall be permitted without enclosures.))*~~

(B) Used as a Raceway. Enclosures shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices, unless the enclosure complies with 312.8.

404.10 Mounting of General-Use Snap Switches, Dimmers, and Control Switches.

(A) ~~**Surface Type.** General-use snap switches, dimmers, and control switches used with open wiring on insulators shall be mounted on insulating material that separates the conductors at least 13 mm (1/2 in.) from the surface wired over.~~ Reserved.

(B) Box Mounted. Flush-type general-use snap switches, dimmers, and control switches mounted in boxes that are set back of the finished surface as permitted in 314.20 shall be installed so that the extension plaster ears are seated against the surface. Flush-type devices mounted in boxes that are flush with the finished surface or project from it shall be installed so that the mounting yoke or strap of the device is seated against the box. Screws used for the purpose of attaching a device to a box shall be of the type provided with a listed device, or shall be machine screws having 32 threads per inch or part of listed assemblies or systems, in accordance with the manufacturer's instructions.

404.13 Knife Switches.

(A) Isolating Switches. Knife switches rated at over 1200 amperes at 250 volts or less, and at over 1000 amperes at 251 to 1000 volts, shall be used only as isolating switches and shall not be opened under load.

(B) To Interrupt Currents. To interrupt currents over 1200 amperes at 250 volts, nominal, or less, or over 600 amperes at 251 to 1000 volts, nominal, a circuit breaker or a switch listed for such purpose shall be used.

(C) General-Use Switches. Knife switches of ratings less than specified in 404.13(A) and (B) shall be considered general-use switches.

Informational Note: See Article 100 for the definition of *general-use switch*.

Δ **(D) Motor-Circuit Switches.** Motor-circuit switches shall be permitted to be of the knife-switch type.

Informational Note: See Article 100 for the definition of *motor-circuit switch*.

(**E**) **Interlocking.** All switches shall be of an interlocking type to prevent the door from being opened when the switch is in the ON position. All switches used as service disconnecting means or those rated over 250 volts shall be

of the two- way interlocking type. For the purpose of this provision, “two-way interlocking” means that the door is prevented from being opened when the switch is ON and prevents the switch from being turned ON when the door is open.

ARTICLE 410
Luminaires, Lampholders, and Lamps

410.10 Luminaires in Specific Locations.

(A) Wet and Damp Locations. Luminaires installed in wet or damp locations shall be installed such that water cannot enter or accumulate in wiring compartments, lampholders, or other electrical parts. All luminaires installed in wet locations shall be marked as suitable for wet locations. All luminaires installed in damp locations shall be marked as suitable for wet locations or suitable for damp locations.

(B) Corrosive Locations. Luminaires installed in corrosive locations shall be of a type suitable for such locations.

(C) In Ducts or Hoods.
Luminaires shall be permitted to be installed in commercial cooking hoods where all of the following conditions are met:

(1) The luminaire shall be identified for use within commercial cooking hoods and installed such that the temperature limits of the materials used are not exceeded.

(2) The luminaire shall be constructed so that all exhaust vapors, grease, oil, or cooking vapors are excluded from the lamp and wiring compartment. Diffusers shall be resistant to thermal shock.

(3) Parts of the luminaire exposed within the hood shall be corrosion resistant or protected against corrosion, and the surface shall be smooth so as not to collect deposits and to facilitate cleaning.

(4) Wiring methods and materials supplying the luminaire(s) shall not be exposed within the cooking hood.

Informational Note: See 110.11 for conductors and equipment exposed to deteriorating agents.

(D) Bathtub and Shower Areas. A luminaire installed in a bathtub or shower area shall meet all of the following requirements:

(1) No parts of cord-connected luminaires, chain-, cable-, or cord-suspended luminaires, lighting track, pendants, or ceiling-suspended (paddle) fans with luminaire (light kit) shall be located within a zone measured ((~~900 mm (3 ft)~~))1.5 M (5 ft) horizontally and 2.5 m (8 ft) vertically from the top of the bathtub rim or shower stall threshold. This zone is all-encompassing and includes the space directly over the tub or shower stall.

(2) Luminaires located within the actual outside dimension of the bathtub or shower to a height of 2.5 m (8 ft) vertically from the top of the bathtub rim or shower threshold or within 5 feet of the waterline shall be marked suitable for damp locations or marked suitable for wet locations. Luminaires located where subject to shower spray shall be marked suitable for wet locations. Luminaires, with exposed metal parts that are grounded, must be ground fault circuit interrupter protected.

Informational Note: WAC 296-46B-410 requirements for protective equipment are incorporated herein with edits.

(E) Luminaires in Indoor Sports, Mixed-Use, and All-Purpose Facilities. Luminaires subject to physical damage, using a mercury vapor or metal halide lamp, installed in playing and spectator seating areas of indoor sports, mixed-use, or all-purpose facilities shall be of the type that protects the lamp with a glass or plastic lens. Such luminaires shall be permitted to have an additional guard.

(F) Luminaires Installed in or Under Roof Decking. Luminaires installed in exposed or concealed locations under roof decking where subject to physical damage shall be installed and supported so there is not less than 38 mm (1 1⁄2 in.) measured from the lowest surface of the roof decking to the top of the luminaire.

Exception: The 38 mm (1 1/2 in.) spacing is not required where metal-corrugated sheet roof decking is covered with a minimum thickness 50 mm (2 in.) concrete slab, measured from the top of the corrugated roofing.

ARTICLE 440
Air-Conditioning and Refrigerating Equipment

440.14 Location.
Disconnecting means shall be located within sight from, and readily accessible from, the air-conditioning or refrigerating equipment. The disconnecting means shall be permitted to be installed on or within the air-conditioning or refrigerating equipment. Disconnecting means shall meet the working space requirements of 110.26(A).

The disconnecting means shall not be located on panels that are designed to allow access to the air-conditioning or refrigeration equipment or where it obscures the equipment nameplate(s).

Exception No. 1: Where the disconnecting means provided in accordance with 430.102(A) is lockable in accordance with ***110.25*** *and the refrigerating or air-conditioning equipment is essential to an industrial process in a facility with written safety procedures, and where the conditions of maintenance and supervision ensure that only qualified persons service the equipment, a disconnecting means within sight from the equipment shall not be required.*

Exception No. 2: Where an attachment plug and receptacle serve as the disconnecting means in accordance with 440.13, their location shall be accessible but shall not be required to be readily accessible.

Exception No 3: In dwelling units, if an indoor unit is served from a separate circuit than the exterior unit, the disconnecting means shall be within sight of the unit, or be capable of being locked in the open position in compliance with 110.25.

Informational Note: See Parts VII and IX of Article 430 for additional requirements.

ARTICLE 450
Transformers and Transformer Vaults (including Secondary Ties)

Δ 450.9 Ventilation.

The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.

Informational Note No. 1: See IEEE C57.12.00-2015, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, and IEEE C57.12.01-2020, *General Requirements for Dry-Type Distribution and Power Transformers*, for additional information.

Informational Note No. 2: See IEEE C57.110-2018, *Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents*, for more information where transformers are used with nonlinear loads that have nonsinusoidal currents that can result in additional losses and transformer heating.

Informational Note No. 3: See *Seattle Building Code* Chapter 4, *Special Detailed Requirements Based on Use and Occupancy*, for additional private and utility vault ventilation and other minimum construction requirements.

Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.

450.19 Location of Pad-Mounted Transformers.

To determine the approved location of pad-mounted transformers, see *Seattle Building Code* Chapter 4 for private and utility vault minimum standards.

450.20 Rating of Dry-Type Transformers.

Dry-type transformers shall be rated not less than the load served as determined in accordance with Article 220 of this *Code*.

450.26 Oil-Insulated Transformers Installed Indoors.

Oil-insulated transformers installed indoors shall be installed in a vault constructed as specified in ((~~Part III of this article~~)) Chapter 4 of the *Seattle Building Code*.

((~~Exception No. 1: Where the total capacity does not exceed 112 1/2 kVA, the vault specified in Part III of this article shall be permitted to be constructed of reinforced concrete that is not less than 100 mm (4 in.) thick.~~))

Exception No. 2: Where the nominal voltage does not exceed 1000, a vault shall not be required if suitable arrangements are made to prevent a transformer oil fire from igniting other materials and the total capacity in one location does not exceed 10 kVA in a section of the building classified as combustible or 75 kVA where the surrounding structure is classified as fire-resistant construction.

Exception No. 3: Electric furnace transformers that have a total rating not exceeding 75 kVA shall be permitted to be installed without a vault in a building or room of fire-resistant construction, provided suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 4: A transformer that has a total rating not exceeding 75 kVA and a supply voltage of 1000 volts or less that is an integral part of charged-particle-accelerating equipment shall be permitted to be installed without a vault in a building or room of noncombustible or fire-resistant construction, provided suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 5: Transformers shall be permitted to be installed in a detached building that does not comply with ~~Part III of this article~~ Chapter 4 of the Seattle Building Code if neither the building nor its contents present a fire

hazard to any other building or property, and if the building is used only in supplying electric service and the interior is accessible only to qualified persons.

~~*((Exception No. 6: Oil-insulated transformers shall be permitted to be used without a vault in portable and mobile surface mining equipment (such as electric excavators) if each of the following conditions is met:*~~
~~*(1) Provision is made for draining leaking fluid to the ground.*~~

~~*(2) Safe egress is provided for personnel.*~~

~~*(3) A minimum 6-mm (1/4-in.) steel barrier is provided for personnel protection.))*~~

450.27 Oil-Insulated Transformers Installed Outdoors.
((~~Combustible material, combustible buildings, and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on roofs, attached to or adjacent to a building or combustible material.~~

~~In cases where the transformer installation presents a fire hazard, one or more of the following safeguards shall be applied according to the degree of hazard involved:~~

~~(1) Space separations~~

~~(2) Fire-resistant barriers~~

~~(3) Automatic fire suppression systems~~

~~(4) Enclosures that confine the oil of a ruptured transformer tank~~

~~Oil enclosures shall be permitted to consist of fire-resistant dikes, curbed areas or basins, or trenches filled with coarse, crushed stone. Oil enclosures shall be provided with trapped drains where the exposure and the quantity of oil involved are such that removal of oil is important.~~

~~Informational Note: See ANSI/IEEE C2-2017, National Electrical Safety Code, for additional information on transformers installed on poles or structures or underground.~~))

(A) Requirements. Oil-insulated transformers installed outdoors shall meet the following requirements:

(1) A transformer installed adjacent to a building or structure having any combustible surface shall be located no closer than 2.4 m (8 ft) to the building or structure and shall be outside a line extended vertically from the ends of the eaves or rooflines as illustrated in the shaded “Approved Transformer Area” shown in Figure 450-1.

(2) A transformer installed adjacent to a building or structure with no combustible surface(s) shall be located no closer than 610 mm (2 ft) to the building or structure and shall be outside a line extended vertically from the ends of the eaves or rooflines as illustrated in the shaded “Approved Transformer Area” shown in Figure 450-2.

(3) A building or structure shall have no doorway, window, stairway, or other openings closer than 3.0 m (10 ft) to the transformer.

(4) The finished grade at the location of the transformer shall have a containment sill such that any oil leaking from a transformer will be contained. The containment sill shall be as high as necessary to contain the oil of one transformer but in no case less than 100 mm (4 in.) high.

(5) If transformers are installed in areas subject to traffic other than pedestrian traffic, they shall be provided with adequate guarding.

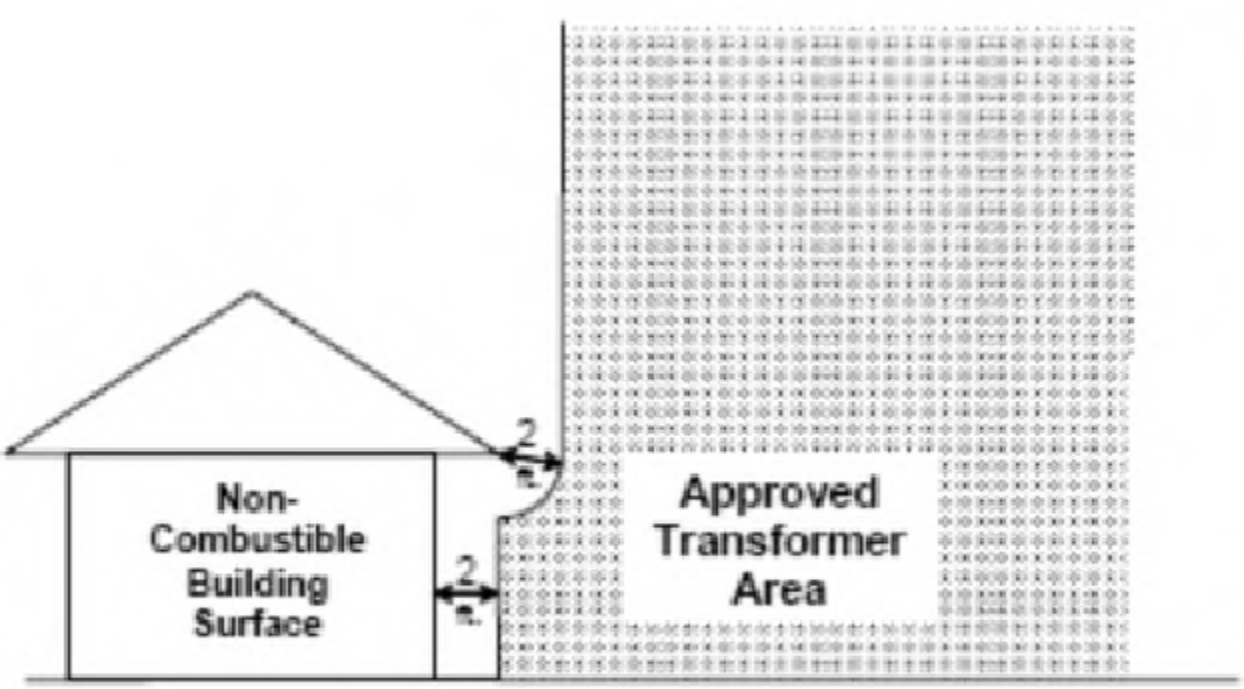


Figure 450-2

(B) Locations. Openings in enclosures for total underground oil-filled transformers shall be located no closer than 3.0 m (10 ft) of a doorway, operable window, stairway or fire escape. Adequate space must be maintained above the enclosure so that a boom may be used to lift the transformer from the enclosure.

Informational Note: WAC 296-46B-450 Equipment for general use – Transformers and transformer vaults. 027 flammable-liquid or oil-filled transformers installed outdoors.

Part III. Transformer Vaults

Sections 450.41 through 450.48 are not adopted. See Chapter 4 of the *Seattle Building Code* for transformer vault requirements.

ARTICLE 500
Hazardous (Classified) Locations Classes I, II, and III, Divisions 1 and 2

500.5 Classifications of Locations.

Δ **(A) General.**

N **(1) Hazardous (Classified) Locations.** Locations shall be classified depending on the properties of the flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that could be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification.

Informational Note: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in a reduced level of classification or in an unclassified location to reduce the amount of special equipment required.

N **(2) Refrigerant Machinery Rooms Using Ammonia**. Refrigerant machinery rooms that contain ammonia refrigeration systems and are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system at a concentration not exceeding 150 ppm shall be permitted to be classified as "unclassified" locations.

Informational Note: See ANSI/IIAR 2, *Standard for Design of Safe Closed-Circuit Ammonia Refrigeration Systems*, for information on classification and ventilation of areas involving closed-circuit ammonia refrigeration systems.

(B) Class I Locations. Class I locations are those in which flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures. Class I locations shall include those specified in 500.5(B)(1) and (B)(2).

(1) Class I, Division 1. A Class I, Division 1 location is a location:

(1) In which ignitible concentrations of flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors can exist under normal operating conditions, or

(2) In which ignitible concentrations of such flammable gases, flammable liquid–produced vapors, or combustible liquids above their flash points might exist frequently because of repair or maintenance operations or because of leakage, or

(3) In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition

Informational Note: This classification usually includes the following locations:

(1) Where volatile flammable liquids or liquefied flammable gases are transferred from one container to another
(2) Interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used
(3) Locations containing open tanks or vats of volatile flammable liquids
(4) Drying rooms or compartments for the evaporation of flammable solvents
(5) Locations containing fat- and oil-extraction equipment using volatile flammable solvents
(6) Portions of cleaning and dyeing plants where flammable liquids are used
(7) Gas generator rooms and other portions of gas manufacturing plants where flammable gas might escape
(8) Inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids
(9) Interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers

(10) Inside of inadequately vented enclosures containing instruments normally venting flammable gases or vapors to the interior of the enclosure
(11) Inside of vented tanks containing volatile flammable liquids
(12) Area between inner and outer roof sections of floating roof tanks containing volatile flammable fluids
(13) Inadequately ventilated areas within spraying or coating operations using volatile flammable fluids
(14) Interior of exhaust ducts used to vent ignitible concentrations of gases or vapors
(15) All other locations where ignitible concentrations of flammable vapors or gases are likely to occur during normal operations

Experience has demonstrated the prudence of avoiding the installation of instrumentation or other electrical equipment in the areas covered in list items (11) through (15). Where it cannot be avoided because it is essential to the process and other locations are not feasible, electrical equipment or instrumentation approved for the specific application or consisting of intrinsically safe systems might be considered.

(4) In which ignitible concentrations of flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors can exist under normal operating conditions in a below grade sump(s) installed in a parking garage(s) and directly cause the electrical sump pump equipment to become a source of ignition.

Exception to (4): The parking garage location may be considered unclassified when an engineer, licensed by the State of Washington, provides sufficient documentation that is stamped and signed by the engineer.

Informational Note: WAC 296-46B-501 001 (3) Any Residential or non- residential system that has building or structure floor drains being discharged into the system is classified as Class I Division I. Drains from any commercially made tub, shower, basin, sink or toilet are not considered floor drains.

ARTICLE 501
Class I Locations

501.2 Sewage disposal systems.

(1) Pumping chambers for sewage, effluent, or grinder pumps in on-site and septic tank effluent pump (S.T.E.P.) disposal systems will be considered unclassified when not more than five residential units are connected to the system, residential units are connected to a utility sewage system, or when nonresidential systems have residential loading characteristics and all of the following general installations requirements are complied with:

a. The pumping chamber must be adequately vented. Venting may be accomplished through the building or structure plumbing vents where the system venting has been approved by the local jurisdiction authority or by a direct two-inch minimum vent to the atmosphere;

b. Equipment that in normal operation may cause an arc or spark must not be installed in any pumping chamber;

c. Float switches installed in a pumping chamber must be hermetically sealed to prevent the entrance of gases or vapors;

d. Junction boxes, conduits and fittings installed in the septic atmosphere must be of a noncorrosive type, installed to prevent the entrance of gases or vapors;

e. Where a conduit system is installed between the pumping chamber and the control panel, motor disconnect, or power source, an approved sealing method must be installed to prevent the migration of gases or vapors from the pumping chamber, and must remain accessible; and

f. Wire splices in junction boxes installed in pumping chambers must be suitable for wet locations.

(2) Residential wastewater loading characteristics in a nonresidential installation:

a. For systems that process less than three thousand five hundred gallons of wastewater per day may be certified by:
(1) An on-site wastewater designer licensed under chapter 18.210 RCW; or
(2) A professional engineer, engaged in the business of on-site wastewater system design, licensed under chapter 18.43 RCW.

b. For systems that process three thousand five hundred gallons or more of wastewater per day may be certified by a professional engineer, engaged in the business of on-site wastewater system design, licensed under chapter 18.43 RCW. Written documentation must be signed and stamped by the designer or engineer and provided to the electrical inspector prior to inspection.

(3) Any residential or nonresidential system that has building or structure floor drains being discharged into the system is classified as Class I Division 1. Drains from any commercially made tub, shower, basin, sink, or toilet are not considered floor drains.

(4) Pumping chamber access covers can be covered by gravel, light aggregate, or noncohesive granulated soil, and must be accessible for excavation. Access covers that are buried must have their exact location identified at the Page 33 of 118 WAC 296-46B-505 Class I, Zone 0, 1, and 2 Locations. electrical panel or other prominent location by an identification plate. The authority having jurisdiction for performing electrical inspections must approve the identification plate location.

(5) Indoor grinder pumps installed in chambers with less than fifty gallons capacity are not required to meet the requirements of this section, except for the venting requirements in subsection (1)(a) of this section. Indoor grinder pumps installed in chambers with less than fifty gallons capacity are not classified systems as described in Article 500 NEC.

(6) Secondary treatment effluent pumping chambers such as sand filters are unclassified, and require no special wiring methods.

(7) Inspection approval is required prior to covering or concealing any portion of the septic electrical system, including the pump. New septic and effluent tanks containing electrical wires and equipment must be inspected and approved prior to being loaded with sewage.

(8) On-site sewage disposal systems using pumps must have audible and visual alarms designed to alert the resident of a malfunction. The alarm must be placed on a circuit independent of the pump circuit.

Informational Note: WAC 296-46B-501 001 Special occupancies – NEC Class I locations are incorporated herein.

ARTICLE 505
Zone 0, 1 and 2 Locations

Δ 505.7 Special Precaution.
This article requires equipment, construction and installation that ensures safe performance under conditions of proper use and maintenance.

Informational Note No. 1: It is important that inspection authorities and users exercise more than ordinary care regarding the installation and maintenance of electrical equipment in hazardous (classified) locations.

Informational Note No. 2: Electrical equipment that is dependent on the protection technique permitted by 505.8(A) might not be suitable for use at temperatures lower than -20°C (-4°F) unless they are identified for use at lower temperatures. Low ambient conditions require special consideration. At low ambient temperatures, flammable concentrations of vapors might not exist in a location classified at normal ambient temperature.

(A) Implementation of Zone Classification System. Classification of areas, engineering and design, selection of equipment and wiring methods, installation, and inspection shall be performed by qualified persons. For the purposes of NEC 505.7, qualified person means a professional engineer registered in Washington.

Informational Note: WAC 296-46B-505 007 Implementation of Zone Classification

(B) Dual Classification. In instances of areas within the same facility classified separately, Zone 2 locations shall be permitted to abut, but not overlap, Class I, Division 2 locations. Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations.

(C) Reclassification Permitted. A Class I, Division 1 or Division 2 location shall be permitted to be reclassified as a Zone 0, Zone 1, or Zone 2 location, provided all of the space that is classified because of a single flammable gas or vapor source is reclassified under the requirements of this article.

(D) Solid Obstacles. Flameproof equipment with flanged joints shall not be installed such that the flange openings are closer than the distances shown in Table 505.7(D) to any solid obstacle that is not a part of the equipment (such as steelworks, walls, weather guards, mounting brackets, pipes, or other electrical equipment) unless the equipment is listed for a smaller distance of separation.

Table 505.7(D) Minimum Distance of Obstructions from Flameproof "d" Flange Openings

	Minimum Distance	
Gas Group	**mm**	**in.**
IIC	40	137⁄64
IIB	30	13⁄16
IIA	10	25⁄64

(E) Simultaneous Presence of Flammable Gases and Combustible Dusts or Fibers/Flyings. Where flammable gases, combustible dusts, or fibers/flyings are or may be present at the same time, the simultaneous presence shall be considered during the selection and installation of the electrical equipment and the wiring methods, including the determination of the safe operating temperature of the electrical equipment.

(F) Available Fault Current for Type of Protection "e". Unless listed and marked for connection to circuits with higher available fault current, the available fault current for electrical equipment using type of protection "e" for the field wiring connections in Zone 1 locations shall be limited to 10,000 rms symmetrical amperes to reduce the likelihood of ignition of a flammable atmosphere by an arc during a short-circuit event.

Informational Note: Limitation of the available fault current to this level may require the application of current-limiting fuses or current-limiting circuit breakers.

ARTICLE 514
Motor Fuel Dispensing Facilities

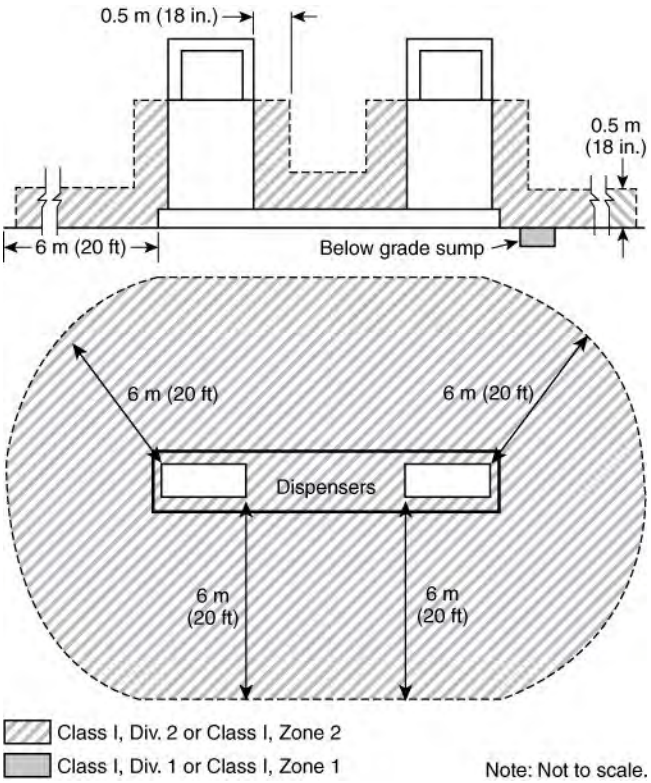
514.1 Scope.
This article shall apply to motor fuel dispensing facilities, marine/motor fuel dispensing facilities, liquefied flammable gas storage or transfer facilities, motor fuel dispensing facilities located inside buildings, and fleet vehicle motor fuel dispensing facilities.

Informational Note 1: The requirements of WAC 296-46B-514 001 are incorporated herein.

Informational Note 2: See NFPA 30A-2021, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, for information regarding safeguards for motor fuel dispensing facilities and for extracted text that is followed by a reference in brackets. Only editorial changes were made to the extracted text to make it consistent with this *Code*.

514.3 Classification of Locations.
Where the term "Class I" is used with respect to Zone classifications within this article of the *Code*, it shall apply to Zone 0, Zone 1, and Zone 2 designations.

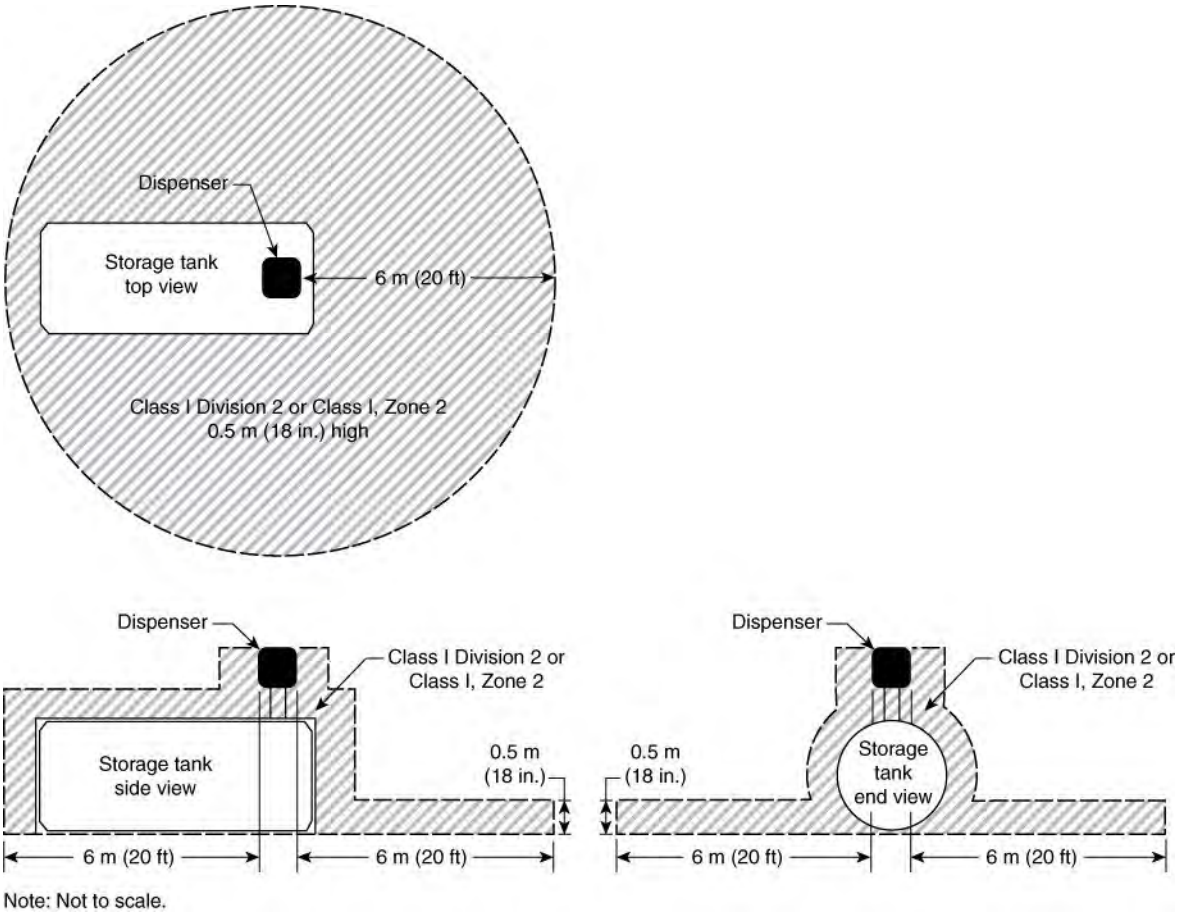
Informational Note: The term "Class I" was originally included as a prefix to Zone 0, Zone 1, and Zone 2 locations and references as an identifier for flammable gases, vapors, or liquids to differentiate from Class II and Class III locations. Zone 0, Zone 1, and Zone 2 only apply to flammable gases, vapors, or liquids so the "Class I" prefix is redundant and has been deleted, except for text that is extracted from other documents or to remain consistent throughout this article.



[See Figure 514.3.]

(A) Unclassified Locations. Where the authority having jurisdiction can satisfactorily determine that flammable liquids having a flash point below 38°C (100°F), such as gasoline, will not be handled, such location shall not be required to be classified.

(B) Classified Locations.
[See Figure 514.3(B).]



Note: Not to scale.

(1) Class I Locations. Table 514.3(B)(1) shall be applied where Class I liquids are stored, handled, or dispensed and shall be used to delineate and classify motor fuel dispensing facilities and commercial garages as defined in Article 100. Table 515.3 shall be used for the purpose of delineating and classifying aboveground tanks. A Class I location shall not extend beyond an unpierced wall, roof, or other solid partition. [30A:8.1, 8.2, 8.3]

Δ **(2) Compressed Natural Gas, Liquefied Natural Gas, and Liquefied Petroleum Gas Areas**. Table 514.3(B)(2) shall be used to delineate and classify areas where CNG, LNG, compressed or liquefied hydrogen, LP-Gas, or combinations of these, are dispensed as motor vehicle fuels along with Class I or Class II liquids that are also dispensed as motor vehicle fuels. [30A:12.1]

Where CNG or LNG dispensers are installed beneath a canopy or enclosure, either the canopy or enclosure shall be designed to prevent accumulation or entrapment of ignitible vapors or all electrical equipment installed beneath the canopy or enclosure shall be suitable for Class I, Division 2 hazardous (classified) locations. [30A:12.4]

Dispensing devices for LP-Gas shall be located as follows:

(1) At least 3 m (10 ft) from any dispensing device for Class I liquids

(2) At least 1.5 m (5 ft) from any dispensing device for Class I liquids where the following conditions exist:

a. The LP-Gas deliver nozzle and filler valve release no more than 4 cm3 (0.1 oz) of liquid upon disconnection.

b. The fixed maximum liquid level gauge remains closed during the entire refueling process. [30A:12.5.2]

Informational Note No. 1: See NFPA 58, Liquefied Petroleum Gas Code, for requirements on dispensing devices for LP-Gas.

Informational Note No. 2: See NFPA 58, Liquefied Petroleum Gas Code, and NFPA 59, Utility LP-Gas Plant Code, for information on classified areas pertaining to LP-Gas systems other than residential or commercial.

Informational Note No. 3: See 514.3(C) for motor fuel dispensing stations in marinas and boatyards.

514.11 Circuit Disconnects

Δ **(A) Emergency Electrical Disconnects.** Fuel dispensing systems shall be provided with one or more clearly identified emergency shutoff devices or electrical disconnects. Such devices or disconnects shall be installed in approved locations but not less than 6 m (20 ft) or more than 30 m (100 ft) from the fuel dispensing devices that they serve. Emergency shutoff devices or electrical disconnects shall disconnect power to all dispensing devices; to all remote pumps serving the dispensing devices; to all associated power, control, and signal circuits; and to all other electrical equipment in the hazardous (classified) locations surrounding the fuel dispensing devices. When more than one emergency shutoff device or electrical disconnect is provided, all devices shall be interconnected. Resetting from an emergency shutoff condition shall require manual intervention and the manner of resetting shall be approved by the authority having jurisdiction. [30A:6.7] The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. Equipment grounding conductors shall remain connected.

An emergency disconnecting means or operator must be provided to disconnect the pump or dispensing equipment serving gasoline, volatile flammable liquids, or liquefied flammable gases. The emergency disconnecting means or operator must disconnect all conductors of the circuit supplying all station dispensers and/or pumps (including the grounded conductor) simultaneously from the source(s) of supply. The disconnecting means must be labeled with an identification plate, with letters at least 1 inch high, as the emergency disconnecting means. The disconnecting means or operator must be substantially red in color.

Exception: Intrinsically safe systems shall not be required to meet this requirement.

(B) Attended Self-Service Motor Fuel Dispensing Facilities.
At attended motor fuel dispensing facilities, the devices or disconnects shall be readily accessible to the attendant. [30A:6.7.1]

(C) Unattended Self-Service Motor Fuel Dispensing Facilities.
At unattended motor fuel dispensing facilities, the devices or disconnects shall be readily accessible to patrons and at least one additional device or disconnect shall be readily accessible to each group of dispensing devices on an individual island. [30A:6.7.2]

(D) Installations with only one dispensing device. The emergency disconnecting means/operator may be used to satisfy subsection (3) of this section.

(E) Multicircuit Installations. An electrically held normally open contactor operated by a push-button may serve as the disconnecting means to satisfy subsection (3) of this section. If a disconnecting pushbutton is used, the

pushbutton may not function as the resetting mechanism for the electrically held contactor. The resetting means must be:

(1) Located at least 15 feet or out of sight from the disconnecting pushbutton;
(2) Installed behind a cover or guard; and
(3) Identified with an identification plate that is substantially black in color.

Informational Note: WAC 296-46B-514 011 Emergency disconnecting means - Dispensing and service stations.

ARTICLE 517
Healthcare Facilities

517.31 Requirements for the Essential Electrical System.

(A) Separate Branches. Type 1 essential electrical systems shall be comprised of three separate branches capable of supplying a limited amount of lighting and power service that is considered essential for life safety and effective hospital operation during the time the normal electrical service is interrupted for any reason. The three branches are life safety, critical, and equipment.

The division between the branches shall occur at transfer switches where more than one transfer switch is required. [99:6.7.2.3.1]

(B) Transfer Switches. Transfer switches shall be in accordance with one of the following:

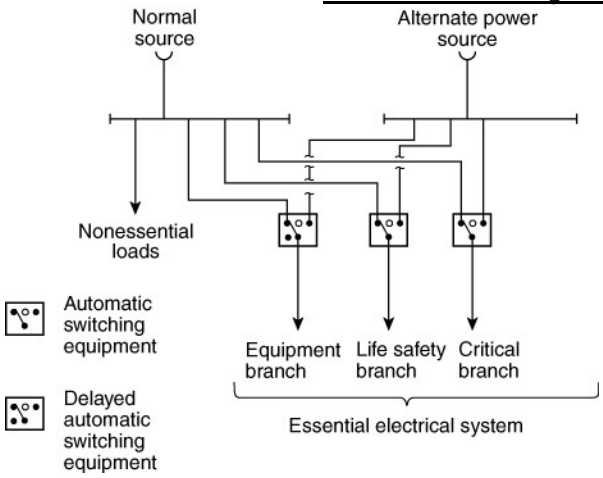
(1) The number of transfer switches to be used shall be based on reliability and design. Each branch of the essential electrical system shall have one or more transfer switches.

(2) One transfer switch shall be permitted to serve one or more branches in a facility with a continuous load on the switch of 150 kVA (120 kW) or less. [99:6.7.6.2.1.4]

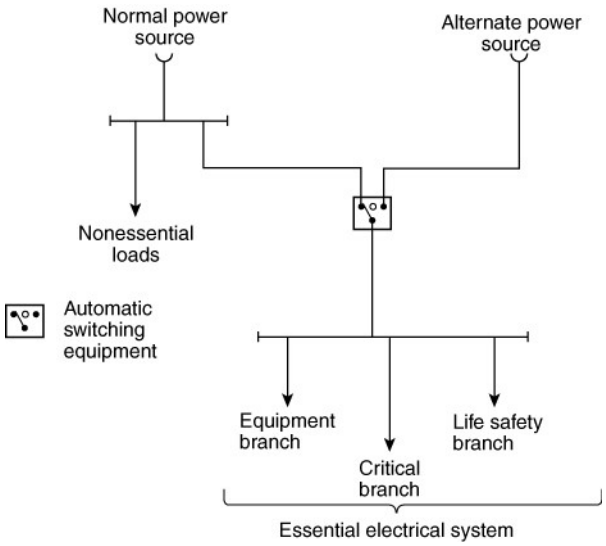
Informational Note No. 1: See NFPA 99-2021, *Health Care Facilities Code*, 6.7.3.1, 6.7.2.2.5, 6.7.2.2.5.15, and 6.7.2.2.7, for more information on transfer switches.

Informational Note No. 2: See **Informational Note Figure 517.31(B)(1)**.

Informational Note No. 3: See **Informational Note Figure 517.31(B)(2)**.



Δ **Informational Note Figure 517.31(B)(1)** Type 1 Essential Electrical System — Minimum Requirement (Greater Than 150 kVA) for Transfer Switch Arrangement.



Δ **Informational Note Figure 517.31(B)(2)** Type 1 Essential Electrical System — Minimum Requirement (150 kVA or Less) for Transfer Switch Arrangement.

(1) Optional Loads. Loads served by the generating equipment not specifically named in this article shall be served by their own transfer switches such that the following conditions apply:

(1) These loads shall not be transferred if the transfer will overload the generating equipment.

(2) These loads shall be automatically shed upon generating equipment overloading.

(2) Contiguous Facilities. Hospital power sources and alternate power sources shall be permitted to serve the essential electrical systems of contiguous or same-site facilities.

(C) Wiring Requirements.

Δ **(1) Separation from Other Circuits.** The life safety branch and critical branch [of the essential electrical system] shall be kept independent of all other wiring and equipment. [99:6.7.5.2.1]

(a) Raceways, cables, or enclosures of the life safety and critical branch shall be readily identified as components of the essential electrical system (EES). Boxes and enclosures (including transfer switches, generators, and power panels) shall be field- or factory-marked and identified as components of the EES. Raceways and cables shall be field- or factory-marked as components of the EES at intervals not to exceed 7.6 m (25 ft).

(b) Conductors of the life safety branch or critical branch shall not enter the same raceways, boxes, or cabinets with each other or any other wiring system. Branch conductors shall be permitted to occupy common equipment, raceways, boxes, or cabinets of other circuits not part of the life safety branch and critical branch where such wiring complies with one of the following:

(1) Is in transfer equipment enclosures

(2) Is in exit or emergency luminaires supplied from two sources

(3) Is in a common junction box attached to exit or emergency luminaires supplied from two sources

(4) Is for two or more circuits supplied from the same branch and same transfer switch

(c) The wiring of the equipment branch shall be permitted to occupy the same raceways, boxes, or cabinets of other circuits that are not part of the essential electrical system.

(d) Where Category 2 locations are served from two separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the Category 2 circuits from the two separate systems shall be kept independent of each other.

(e) Where Category 1 locations are served from two separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No. 2, the critical care circuits from the two separate systems shall be kept independent of each other.

(2) Isolated Power Systems. Where isolated power systems are installed in any of the areas in 517.34(A)(1) and (A)(2), each system shall be supplied by an individual circuit serving no other load.

Δ **(3) Mechanical Protection of the Essential Electrical System.** The wiring of the life safety and critical branches shall be mechanically protected by raceways. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B) and 250.118. Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care spaces.

(2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care spaces.

(3) Listed flexible metal raceways and listed metal sheathed cable assemblies, as follows:

a. Where used in listed prefabricated medical headwalls

b. In listed office furnishings

c. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage

d. Where necessary for flexible connection to equipment

e. For equipment that requires a flexible connection due to movement, vibration, or operation

f. Luminaires installed in ceiling structures

(4) Flexible power cords of appliances or other utilization equipment connected to the essential electrical system.

(5) Cables for Class 2 or Class 3 systems permitted in Part VI of this article, with or without raceways.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Δ **(D) Capacity of Systems.** The essential electrical system shall have the capacity and rating to meet the maximum actual demand likely to be produced by the connected load.

Feeders shall be sized in accordance with 215.2 and Part III of Article 220. The alternate power source(s) required in 517.30 shall have the capacity and rating to meet the demand produced by the load at any given time. Demand calculations for sizing of the alternate power source(s) shall be based on any of the following:

(1) Prudent demand factors and historical data

(2) Connected load

(3) Feeder calculations

(4) Any combination of the above

The sizing requirements in 700.4 and 701.4 shall not apply to alternate sources.

(E) Receptacle Identification. The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [99:6.7.2.2.5(B)]

(F) Feeders from Alternate Power Source.
A single feeder supplied by a local or remote alternate power source shall be permitted to supply the essential electrical system to the point at which the life safety, critical, and equipment branches are separated. Installation of the transfer equipment shall be permitted at other than the location of the alternate power source.

(G) Coordination.
Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Selective coordination shall be selected by a licensed professional engineer or other qualified person engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception No. 1: Coordination shall not be required between transformer primary and secondary overcurrent protective devices where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Coordination shall not be required between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note No. 1: The terms *coordination* and *coordinated* as used in this section do not cover the full range of overcurrent conditions.

Informational Note No. 2: See 517.17(C) for information on requirements for the coordination of ground-fault protection.

ARTICLE 555
Marinas, Boatyards, Floating Buildings, and Commercial and Noncommercial Docking Facilities

555.4 Location of Service Equipment.
The service equipment for a floating building, dock, or marina shall be located on land no closer than 1.5 m (5 ft) horizontally from and adjacent to the structure served, but not on or in the structure itself or any other floating structure. Service equipment shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane.
Exception: In existing installations, the service may be located in or on the building only by prior approval from the authority having jurisdiction.

555.5 Maximum Voltage.
Pier Power distribution shall not exceed 250 volts phase to phase. Pier power distribution systems, where qualified personnel service the equipment under engineering supervision, shall be permitted to exceed 250 volts but these systems shall not exceed 600 volts.

555.7 Transformers.
(A) General. Transformers and enclosures shall be identified for wet locations. The bottom of transformer enclosures shall not be located below the electrical datum plane.

(B) Replacements. Transformers and enclosures shall be identified for wet locations where replacements are made.

For the purposes of NEC 555.7, transformer terminations must be located a minimum of 12 inches above the deck of a dock (datum plane requirements do not apply for this section).

Informational Note: The requirements of WAC 296-46B-555(1) are incorporated herein.

555.25 Luminaires Required.
All walkways over water shall be illuminated to provide safe egress.

Informational Note: Chapter 4 of the *Seattle Building Code* requires that waterfront structures comply with Chapter 10 for means of egress requirements, including illumination.

555.30 Electrical Equipment and Connections.

Δ **(A) General.** All electrical components within electrical equipment (excluding wiring methods) and connections not intended for operation while submerged shall be located at least 305 mm (12 in.) above the deck of a fixed or floating structure, but not below the electrical datum plane. Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required for floating structures where located above the waterline but below the electrical datum plane.

Δ **(B) Replacements.** Replacement electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating or fixed structure. Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required where located above the waterline but below the electrical datum plane.

For the purposes of NEC 555.30, all electrical connections must be installed a minimum of 12 inches above the deck of a pier unless the connections are within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion. (datum plane requirements do not apply for this section).

Informational Note: WAC 296-46B-555 (3) Electrical connections

555.31 Electrical Equipment Enclosures.

(A) Securing and Supporting. Electrical equipment enclosures installed on piers above deck level shall be securely and substantially supported by structural members, independent of any conduit connected to them. If enclosures are not attached to mounting surfaces by means of external ears or lugs, the internal screw heads shall be sealed to prevent seepage of water through mounting holes.

(B) Location. Electrical equipment enclosures on piers shall be located so as not to interfere with mooring lines. For the purposes of NEC 555.31, all enclosures must be corrosion resistant. All gasketed enclosures must be arranged with a weep hole to discharge condensation.

Informational Note: WAC 296-46B-555 (4) Electrical Equipment

555.51 Feeder Conductors. Each floating building shall be supplied by a single set of feeder conductors from its service equipment.

Exception: Where the floating building has multiple occupancy, each occupant shall be permitted to be supplied by a single set of feeder conductors extended from the occupant's service equipment to the occupant's panelboard.

Where shore power is provided, a disconnecting means must be located within sight of each floating building or similar facility. The disconnecting means must be installed adjacent to but not in or on the floating building or similar facility.

Informational Note: WAC 296-46B-555 (8) Disconnect means within sight

555.53 Ground-Fault Protection.
The main overcurrent protective device that feeds the floating building shall have ground-fault protection not exceeding ((~~100 mA~~)) 30mA. Ground-fault protection of each individual branch or feeder circuit shall be permitted as a suitable alternative. Outdoor outlets, shore power outlets, and boat hoists located at floating buildings shall comply with 555.35(B) and (C).

Informational Note: Requirements of WAC 296-46B-555(9) incorporated herein

ARTICLE 590
Temporary Installations

590.2 All Wiring Installations.

(A) Other Articles. Except as specifically modified in this article, all other requirements of this Code for permanent wiring shall apply to temporary wiring installations.

(B) Approval. Temporary wiring methods shall be acceptable only if approved based on the conditions of use and any special requirements of the temporary installation. A temporary service shall only be approved if accompanied by a building, land use, or trade permit demonstrating a need for electric power.

ARTICLE 600
Electric Signs and Outline Lighting

600.1 Scope. This article covers the installation of conductors, equipment, and field wiring for electric signs, retrofit kits, and outline lighting, regardless of voltage. All installations and equipment using neon tubing, such as signs, decorative elements, skeleton tubing, or art forms, are covered by this article.

Additionally, each of the following is covered by this article:

1. All electrical signs and outline lighting, regardless of voltage must be listed to the applicable ANSI UL Standard. Installations will be inspected for compliance with installation instructions and this *Code.*
2. Luminaires in outdoor awnings must be suitable for wet locations and be connected by a wiring method suitable for wet locations.
3. Fluorescent and LED luminaires must be located at least 152 mm (6 in.) from the awning fabric. Incandescent lamps or luminaires must be located at least 457 mm (18 in.) from awning fabric. A disconnecting means must be installed per Article 600 of this *Code.*
4. Listed awning signs must be installed in compliance with the manufacturer's instructions and this *Code.*
5. Retrofitting Signs. When listed signs or listed outline lighting are retrofitted to an LED light source, a licensed general electrical contractor or an electrical sign contractor using properly certified individuals or properly supervised trainees may make the retrofit in place so long as the retrofit kit is listed and a new sign permit is obtained prior to the retrofit kit being in- stalled. The retrofit kit manufacturer's installation instructions shall be made available for the inspector's use at the time of the inspection. The inspector shall be provided with an on-site means to verify the installation at the time of inspection.

Informational Note No. 1: Sign and outline lighting illumination systems include, but are not limited to, cold cathode neon tubing, high-intensity discharge lamps (HID), fluorescent or incandescent lamps, light-emitting diodes (LEDs), and electroluminescent and inductance lighting.

Informational Note No. 2: WAC 296-46B-600, requirements for electric signs and outline lighting, is incorporated herein with edits.

Informational Note No. 3: Inspections for retrofits must be scheduled at least 24 hours in advance of the work being performed.

600.2 Definitions. The definitions in this section shall apply only within this article.

Overhead Electrical Conductors. Any exterior electrical conductor, either bare or insulated, installed above the ground except those conductors enclosed in an approved raceway or enclosure. Overhead electrical conductors include but are not limited to overhead powerlines, overhead utility conductors, overhead service drops, overhead feeders, etc.

Informational Note: Also see Chapter 31 of the *Seattle Building Code* for regulation of signs and awnings.

ARTICLE 620
Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts

620.1 Scope.
This article covers the installation of electrical equipment and wiring used in connection with elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts.

Informational Note No. 1: See ASME A17.1-2019/CSA B44:19, *Safety Code for Elevators and Escalators*, for information on the installation of elevators and escalators.

Informational Note No. 2: See CSA B44.1:19/ASME A17.5-2019, *Elevator and escalator electrical equipment*, for information on elevator and escalator electrical equipment.

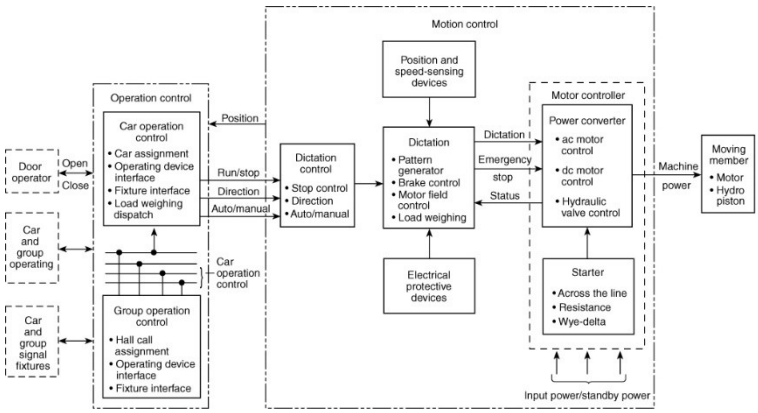
Informational Note No. 3: See ASME A18.1-2020, *Safety Standard for Platform Lifts and Stairway Chairlifts*, for information on installation of platform lifts and stairway chairlifts. The term *wheelchair lift* has been changed to platform lift.

Informational Note No. 4: The motor controller, motion controller, and operation controller are located in a single enclosure or a combination of enclosures.

Informational Note No. 5: See Informational Note Figure 620.1 for information only.

Informational Note No. 6: See Chapter 7 of the *Seattle Building Code* for requirements to pressurize elevator hoistways and elevator lobbies.

Informational Note No. 7: See Chapter 10 of the *Seattle Building Code* for requirements for elevators serving as an accessible means of egress component (in buildings that have a required accessible floor that is four or more stories above or below the level of exit discharge) and for pressurization of elevator lobbies used as an area of refuge.



Informational Note Figure 620.1 Control System.

620.5 Working Clearances.
Working space shall be provided about controllers, disconnecting means, and other electrical equipment in accordance with 110.26(A).

Where conditions of maintenance and supervision ensure that only qualified persons examine, adjust, service, and maintain the equipment, the clearance requirements of 110.26(A)(1) shall not be required where ((~~any of~~)) the condition((~~s in~~)) of 620.5(A)(1) ((~~through (D) are~~)) is met.

(A) Flexible Connections to Equipment. Electrical equipment in the following is provided with flexible leads to all external connections so that it can be repositioned to meet the clear working space requirements of 110.26:

(1) Controllers and disconnecting means for ((~~dumbwaiters,~~)) escalators ((~~,~~)) and moving walks ((~~, platform lifts, and stairway chairlifts installed in the same space with the driving machine~~

~~(2) Controllers and disconnecting means for elevators installed in the hoistway or on the car~~

~~(3) Controllers for door operators~~

~~(4) Other electrical equipment installed in the hoistway or on the car~~

~~**(B) Guards**. Live parts of the electrical equipment are suitably guarded, isolated, or insulated to reduce the likelihood of inadvertent contact with live parts operating at voltages greater than 30 volts ac rms, 42 volts ac peak, or 60 volts dc, and the equipment can be examined, adjusted, serviced, or maintained while energized without removal of this protection.~~

~~**(C) Examination, Adjusting, and Servicing.**~~

~~Electrical equipment is not required to be examined, adjusted, serviced, or maintained while energized.~~

~~**(D) Low Voltage.**~~

~~Uninsulated parts are at a voltage not greater than 30 volts rms, 42 volts peak, or 60 volts dc.~~))

Informational Note No. 1: For additional requirements, see Section 3020.6 of the Seattle Building Code.

Δ 620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

N **(A) Pits, Hoistways, and on Cars.** Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, ((~~associated with wind turbine tower~~)) elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be a listed Class A ground-fault circuit-interrupter type.

N **(B) Machine Rooms, Control Spaces, Machinery Spaces, Control Rooms, and Truss Interiors.** All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, control rooms, and truss interiors shall have listed Class A ground-fault circuit-interrupter protection for personnel.

N **(C) Sump Pumps.** A permanently installed sump pump shall be permanently wired or shall be supplied by a receptacle that is protected by a listed Class A ground-fault circuit-interrupter.

620.21 Wiring Methods.

Conductors, cables, and optical fiber cables located in hoistways, escalator and moving walk wellways, platform lifts, stairway chairlift runways, machinery spaces, control spaces, in or on cars, machine rooms, and control rooms, not including the traveling cables connecting the car or counterweight and hoistway wiring, shall be installed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, rigid nonmetallic conduit, or wireways, or shall be Type MC, MI, or AC cable unless otherwise permitted in 620.21(A) through (C). Unused conductors in an enclosure shall be insulated or protected from accidental contact with exposed live parts.

Type AC, MC, or MI cable may be permitted to be installed in elevator spaces in lengths not exceeding six feet.

Exception: Cords and cables of listed cord-and-plug-connected equipment shall not be required to be installed in a raceway.

Informational Note: When an elevator is classified as a fire service access elevator or occupant evacuation operation elevator, some building codes require additional protection for conductors that are located outside of the elevator hoistway and machine room.

(A) Elevators.

(1) Hoistways and Pits.

(a) ((~~Types CL2P, CL2R, and CL2 cables shall be permitted, provided the cables are supported and protected from physical damage. Substitute cables for Class 2 cables installed in accordance with 722.135(E) shall be permitted.~~))Feeders shall be permitted inside the hoistway for elevators with driving machine motors located in the hoistway or on the car or counterweight.

(b) Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted, provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.

(c) The following wiring methods shall be permitted in the hoistway in lengths not to exceed 1.8 m (6 ft):

(1) Flexible metal conduit.

(2) Liquidtight flexible metal conduit.

(3) ((~~Liquidtight flexible nonmetallic conduit.~~)) Reserved

(4) ((~~Flexible cords and cables, or conductors grouped together and taped or corded, shall be permitted to be installed without a raceway. They shall be located to be protected from physical damage, shall be of a flame-retardant type, and shall be part of one of the following:~~)) Reserved

((~~a. Listed equipment~~

~~b. Driving machine~~

~~c. Driving machine brake~~

~~*Exception to 620.21(A)(1)(c)(1), (A)(1)(c)(2), and (A)(1)(c)(3):*~~
~~*The conduit length shall not be required to be limited between risers and limit switches, interlocks, operating buttons, and similar devices.*~~))

(d) A sump pump or oil recovery pump located in the pit shall be permitted to be cord connected. The cord shall be a hard usage oil-resistant type, of a length not to exceed 1.8 m (6 ft), and shall be located to be protected from physical damage.

(e) ~~Hard-service cords and junior hard-service cords that conform to the requirements of Article 400 (Table 400.4) shall be permitted as flexible connections between the fixed wiring in the hoistway and hoistway access switches when located in the hoistway door sight guard.~~ Reserved.

((~~Informational Note: See ASME A17.1-2019/CSA B44-19, *Safety Code for Elevators and Escalators.*~~))

(f) Flexible metal conduit or liquidtight flexible metal conduit shall be permitted in hoistways between risers and limit switches, interlocks, operating buttons, and similar devices. Flexible conduit runs are limited to 1.8 m (6 ft) in length.

(g) Nonmetallic raceways and wireways shall not be installed in hoistways required to be of noncombustible fire-resistive construction.

(2) Cars.

(a) Flexible metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit of metric designator 12 (trade size 3⁄8), or larger, not exceeding ((~~1.8 m (6 ft)~~)) 3 ft in length, shall be

permitted on cars where so located as to be free from oil and if securely fastened in place. Flexible conduit of any type shall not be placed in locations where it would be subject to physical damage.

~~*Exception: Liquidtight flexible nonmetallic conduit (LFNC-B) of metric designator 12 (trade size 3/8) or larger shall be permitted in lengths in excess of 1.8 m (6 ft).*~~

(b) Hard-service cords and junior hard-service cords that conform to the requirements of Article 400 (Table 400.4) shall be permitted as flexible connections between the fixed wiring on the car and devices on the car doors or gates. Hard-service cords only shall be permitted as flexible connections for the top-of-car operating device or the car-top work light. Devices or luminaires shall be grounded by means of an equipment grounding conductor run with the circuit conductors. Cables with smaller conductors and other types and thicknesses of insulation and jackets shall be permitted as flexible connections between the fixed wiring on the car and devices on the car doors or gates, if listed for this use.

(c) ~~Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted, provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.~~ Nonmetallic raceways and wireways shall not be installed on cars located in hoistways required to be of noncombustible fire-resistive construction.

(d) The following wiring methods shall be permitted on the car assembly in lengths not to exceed ((~~1.8 m (6 ft)~~)) 3 ft

(1) Flexible metal conduit

(2) Liquidtight flexible metal conduit

(3) Liquidtight flexible nonmetallic conduit

(4) Flexible cords and cables, or conductors grouped together and taped or corded, shall be permitted to be installed without a raceway. They shall be located to be protected from physical damage and shall be of a flame-retardant type and shall be part of one of the following:

a. Listed equipment

b. A driving machine

c. A driving machine brake

Δ (3) Within Machine Rooms, Control Rooms, and Machinery Spaces and Control Spaces.

(a) Flexible metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit of metric designator 12 (trade size 3/8), or larger, not exceeding 1.8 m (6 ft) in length, shall be permitted between control panels and machine motors, machine brakes, motor-generator sets, disconnecting means, and pumping unit motors and valves.
~~*Exception: Liquidtight flexible nonmetallic conduit (LFNC-B) metric designator 12 (trade size 3/8) or larger shall be permitted to be installed in lengths in excess of 1.8 m (6 ft).*~~

(b) Where motor-generators, machine motors, or pumping unit motors and valves are located adjacent to or underneath control equipment and are provided with extra-length terminal leads not exceeding 1.8 m (6 ft) in length, such leads shall be permitted to be extended to connect directly to controller terminal studs without regard to the carrying-capacity requirements of Articles 430 and 445. Auxiliary gutters shall be permitted in machine and control rooms between controllers, starters, and similar apparatus.

(c) Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted, provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.

(d) On existing or listed equipment, conductors shall also be permitted to be grouped together and taped or corded without being installed in a raceway. Such cable groups shall be supported at intervals not over 900 mm (3 ft) and located so as to be protected from physical damage.

(e) Flexible cords and cables in lengths not to exceed ((~~1.8 m (6 ft)~~)) 3 ft that are of a flame-retardant type and located to be protected from physical damage shall be permitted in these rooms and spaces without being installed in a raceway. They shall be part of one of the following:
(1) Listed equipment

(2) A driving machine

(3) A driving machine brake

(4) Counterweight. The following wiring methods shall be permitted on the counterweight assembly in lengths not to exceed ~~1.8 m (6 ft)~~ 3 ft:

(1) Flexible metal conduit

(2) Liquidtight flexible metal conduit

(3) Liquidtight flexible nonmetallic conduit

(4) Flexible cords and cables, or conductors grouped together and taped or corded, shall be permitted to be installed without a raceway. They shall be located to be protected from physical damage, shall be of a flame-retardant type, and shall be part of one of the following:

a. Listed equipment

b. A driving machine

c. A driving machine brake

(B) Escalators.

Δ **(1) Wiring Methods.** Flexible metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit shall be permitted in escalator and moving walk wellways. Flexible metal conduit or liquidtight flexible conduit of metric designator 12 (trade size 3⁄8) shall be permitted in lengths not in excess of 1.8 m (6 ft).

Exception: Metric designator 12 (trade size 3/8), nominal or larger liquidtight flexible nonmetallic conduit (LFNC-B) shall be permitted to be installed in lengths in excess of 1.8 m (6 ft).

(2) Class 2 Circuit Cables. Types CL2P, CL2R, and CL2 cables shall be permitted to be installed within escalators and moving walkways, provided the cables are ((~~supported and protected~~)) installed in a raceway for protection from physical damage and the cables are of a jacketed and flame-retardant type. Substitute cables for Class 2 cables installed in accordance with 722.135(E) shall be permitted.

(3) Flexible Cords. Hard-service cords that conform to the requirements of Article 400 (Table 400.4) shall be permitted as flexible connections on escalators and moving walk control panels and disconnecting means where the entire control panel and disconnecting means are arranged for removal from machine spaces as permitted in 620.5.

(C) Platform Lifts and Stairway Chairlift Raceways.

(1) Wiring Methods. Flexible metal conduit or liquidtight flexible metal conduit shall be permitted in platform lifts and stairway chairlift runways and machinery spaces. Flexible metal conduit or liquidtight flexible conduit of metric designator 12 (trade size 3⁄8) shall be permitted in lengths not in excess of 1.8 m (6 ft).

Exception: Metric designator 12 (trade size 3⁄8) or larger liquidtight flexible nonmetallic conduit (LFNC-B) shall be permitted to be installed in lengths in excess of 1.8 m (6 ft).

(2) Class 2 Circuit Cables. Types CL2P, CL2R, and CL2 traveling cables shall be permitted to be installed within platform lifts and stairway chairlift runways and machinery spaces, provided the cables are supported and protected from physical damage. Substitute cables for Class 2 cables installed in accordance with 722.135(E) shall be permitted.

(3) Flexible Cords and Cables. Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted in lengths not to exceed 1.8 m (6 ft), provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.

620.26 Panelboards. All branch circuits required by 620.22, 620.23, and 620.25 shall originate from a panelboard in the elevator machine room or control room. The panelboard enclosure may have a door with a latch, but the enclosure door cannot be lockable.

Exception 1: A separate branch circuit for pit lighting and receptacle shall be allowed in accordance with 620.24 from other than in the elevator machine room or control room.

Exception 2: Private residence elevators are exempt from this ordinance.

620.27 Prohibited Equipment in Elevator Machine Room or Control Room.
Any electrical equipment on the line side of the panelboard required in 620.26, including a main breaker in the panelboard, or elevator disconnecting means, shall be prohibited in the elevator machine room or the control room.

Exception: Transformers 30 kva or less, and their associated secondary conductor overcurrent protection/disconnects, supplying associated elevator or machine/control room loads, subject to the following:

1. *Required elevator machine/control room electrical clearances shall be maintained.*
2. *The added heat load of the transformer shall be considered for machine/control room heating and cooling and ventilation. The BTUs of the transformer and the elevator equipment manufacturer shall be included in the HVAC calculation for the elevator machine/control room to ensure safe and normal operation of the elevator.*
3. *The heat output of the transformer in BTUs shall be posted in a visible location on the transformer.*

620.44 Installation of Traveling Cables.
Traveling cables that are suitably supported and protected from physical damage shall be permitted to be run without the use of a raceway in either or both of the following:

(1) When used inside the hoistway, on the elevator car, hoistway wall, counterweight, or controllers and machinery that are located inside the hoistway, provided the cables are in the original sheath.

(2) From inside the hoistway, to elevator controller enclosures and to elevator car and machine room, control room, machinery space, and control space connections that are located outside the hoistway for a distance not

exceeding 1.8 m (6 ft) in length as measured from the first point of support on the elevator car or hoistway wall, or counterweight where applicable, provided the conductors are ((~~grouped together and taped or corded, or~~)) in the original sheath. These traveling cables shall be permitted to be continued to this equipment.

620.51 Disconnecting Means.
A single means for disconnecting all ungrounded main power supply conductors for each elevator, dumbwaiter, escalator, moving walk, platform lift, or stairway chairlift shall be provided and be designed so that no pole can be operated independently. Where multiple driving machines are connected to a single elevator, escalator, moving walk, or pumping unit, there shall be one disconnecting means to disconnect the motor(s) and control valve operating magnets.

The disconnecting means for the main power supply conductors shall not disconnect the branch circuits required in 620.22, 620.23, and 620.24.

(A) Type. The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker that is lockable only in the open position in accordance with 110.25. If circuit breaker type disconnect is used, it shall not have a door or cover over the breaker. The disconnecting means shall be a listed device.

Informational Note No. 1: See ASME A17.1-2019/CSA B44-19, *Safety Code for Elevators and Escalators*, for additional information.

Informational Note No. 2: See ASME A18.1-2017, *Safety Standard for Platform Lifts and Stairway Chairlifts*, for additional information.

Exception No. 1: Where an individual branch circuit supplies a platform lift, the disconnecting means required by 620.51(C)(4) shall be permitted to comply with 430.109(C). This disconnecting means shall be listed and shall be lockable open in accordance with 110.25.

Exception No. 2: Where a((~~n individual~~)) branch circuit supplies a stairway chairlift or where a stairway chairlift is supplied by batteries as the primary source, the stairway chairlift shall be permitted to be cord-and-plug-connected, provided it complies with 422.16(A) and the cord does not exceed 1.8 m (6 ft) in length.

(B) Operation. No provision shall be made to open or close this disconnecting means from any other part of the premises. If sprinklers are installed in hoistways, machine rooms, control rooms, machinery spaces, or control spaces, the disconnecting means shall be permitted to automatically open the power supply to the affected elevator(s) prior to the application of water. No provision shall be made to automatically close this disconnecting means. Power shall only be restored by manual means.

Informational Note: To reduce hazards associated with water on live elevator electrical equipment.

(C) Location. The disconnecting means shall be located where it is readily accessible to qualified persons.

Informational Note: See Seattle Building Code 3020.6 for specific location requirements of disconnects

(1) On Elevators Without Generator Field Control. On elevators without generator field control, the disconnecting means shall be located within sight of the motor controller. Where the motor controller is located in the elevator hoistway, the disconnecting means required by 620.51(A) shall be located outside the hoistway and accessible to qualified persons only. An additional fused or non-fused, enclosed, externally operable motor-circuit switch that is lockable open in accordance with 110.25 to disconnect all ungrounded main power-supply conductors shall be located within sight of the motor controller. The additional switch shall be a listed device and shall comply with 620.91(C).

Driving machines or motion and operation controllers not within sight of the disconnecting means shall be provided with a manually operated switch installed in the control circuit to prevent starting. The manually operated switch(es) shall be installed adjacent to this equipment.

Where the driving machine of an electric elevator or the hydraulic machine of a hydraulic elevator is located in a remote machine room or remote machinery space, a single means for disconnecting all ungrounded main power-supply conductors shall be provided and be lockable open in accordance with 110.25.

(2) On Elevators with Generator Field Control. On elevators with generator field control, the disconnecting means shall be located within sight of the motor controller for the driving motor of the motor-generator set. Driving machines, motor-generator sets, or motion and operation controllers not within sight of the disconnecting means shall be provided with a manually operated switch installed in the control circuit to prevent starting. The manually operated switch(es) shall be installed adjacent to this equipment.
Where the driving machine or the motor-generator set is located in a remote machine room or remote machinery space, a single means for disconnecting all ungrounded main power-supply conductors shall be provided and be lockable open in accordance with 110.25.

(3) On Escalators and Moving Walks. On escalators and moving walks, the disconnecting means shall be installed in the space where the controller is located.

(4) On Platform Lifts and Stairway Chairlifts. On platform lifts and stairway chairlifts, the disconnecting means shall be located within sight of the motor controller.

(D) Identification and Signs.

(1) Available Fault Current Field Marking. The disconnecting means shall be legibly marked in the field with the available fault current at its line terminals. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved.
When modifications to the electrical installation occur that affect the available fault current at the disconnecting means, the available fault current shall be verified or recalculated as necessary to ensure the elevator equipment's short-circuit current rating is sufficient for the available fault current at the line terminals of the equipment. The required field marking(s) shall be adjusted to reflect the new level of available fault current.

(E) Surge Protection. Where any of the disconnecting means in 620.51 has been designated as supplying an emergency system load, a legally required system load, or a critical operation power system load, a listed SPD shall be installed.

(F) Automatic Power Disconnect Device Control Circuit (Where Provided). The control circuit for a required automatic power disconnect device or shunt trip shall be derived either from:

(1) Within the disconnecting means enclosure when the shunt trip circuit equipment is a part of the listed assembly and the control-circuit controls only the disconnect(s) within the listed equipment; or

(2) A dedicated circuit from an appropriate panelboard located in the machine room.

620.53 Car Light, Receptacle(s), and Ventilation Disconnecting Means.
Elevators shall have a single means for disconnecting all ungrounded car light, receptacle(s), and ventilation power-supply conductors for that elevator car.

The disconnecting means shall be an enclosed, externally operable, fused motor-circuit switch or circuit breaker that is lockable open in accordance with 110.25 and shall be located in the machine room or control room for that elevator car. ((~~Where there is no machine room or control room outside the hoistway, the disconnecting means shall be located outside the hoistway and accessible to qualified persons only.~~))

Disconnecting means shall be numbered to correspond to the identifying number of the elevator car whose light source they control.

The disconnecting means shall be provided with a sign to identify the location of the supply side overcurrent protective device.

Exception: Where a separate branch circuit supplies car lighting, a receptacle(s), and a ventilation motor not exceeding 2 hp, the disconnecting means required by 620.53 shall be permitted to comply with 430.109(C). This disconnecting means shall be listed and shall be lockable open in accordance with 110.25.

620.62 Selective Coordination.
Where more than one driving machine disconnecting means is supplied by the same source, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified person engaged primarily in the design, installation, or maintenance of electrical systems. The selection and device settings shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception No. 1: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception No. 2: When an electrical engineer provides stamped fault current calculations, the overcurrent protective devices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

Exception 3: When an electrical engineer provides stamped fault current calculations, the overcurrent protective de- vices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

620.71 ((~~Guarding~~)) Securing Equipment.
Elevator, dumbwaiter, escalator, and moving walk driving machines; motor-generator sets; motor controllers; and disconnecting means shall be installed in a room or space set aside for that purpose unless otherwise permitted in 620.71(A) or (B). The room or space shall be secured against unauthorized access.

Non-elevator equipment, wiring, pipes, and other materials are prohibited in elevator hoistways, pits, machine rooms and control rooms. Only such equipment and wiring that pertain directly to the elevator and its operation are permitted in these spaces. See Chapter 30 of the *Seattle Building Code*.

Exception: Elevator motor controllers may be installed, with permission of the authority having jurisdiction, in a hoistway.

(A) Motor Controllers. ~~((Motor controllers shall be permitted outside the spaces herein specified, provided they are in enclosures with doors or removable panels that are capable of being locked in the closed position and the disconnecting means is located adjacent to or is an integral part of the motor controller.))~~ Motor controller enclosures for escalator or moving walks shall be permitted in the balustrade on the side located away from the moving steps or moving treadway. If the disconnecting means is an integral part of the motor controller, it shall be operable without opening the enclosure.

(B) Driving Machines. Elevators with driving machines located on the car, on the counterweight, or in the hoistway, and driving machines for dumbwaiters, platform lifts, and stairway lifts, shall be permitted outside the spaces herein specified.

620.91 Emergency and Standby Power Systems.
((~~Elevators shall be permitted to be powered by an emergency or standby power system.~~)) Elevator power system requirements are determined by the Seattle Building Code.

Informational Note No. 1: See ASME A17.1-2016/CSA B44-16, Safety Code for Elevators and Escalators, 2.27.2, for additional information.

Informational Note No. 2: When an elevator is classified as a fire service access elevator or occupant evacuation operation elevator, ((~~some building codes require~~)) the elevator equipment, elevator hoistway lighting, ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces and control spaces ((~~as well as~~)), elevator car lighting, as well as elevator pit sump pumps ((~~to~~)) should be supplied by emergency or standby power systems ((~~in compliance with Article 701~~)) as required by the *Seattle Building Code*.

Informational Note No. 3: See Chapter 7 of the Seattle Building Code for requirements to pressurize elevator hoistways and elevator lobbies.

Informational Note No. 4: See Chapter 10 of the Seattle Building Code for requirements for elevators serving as an accessible means of egress component (in buildings that have a required accessible floor that is four or more stories above or below the level of exit discharge) and for pressurization of elevator lobbies used as an area of refuge.

(A) Regenerative Power. For elevator systems that regenerate power back into the power source that is unable to absorb the regenerative power under overhauling elevator conditions, a means shall load be provided to absorb this power.

(B) Other Building Loads. Other building loads, such as power and lighting, shall be permitted as the energy absorption means required in 620.91(A), provided that such loads are automatically connected to the emergency or standby power system operating the elevators and are large enough to absorb the elevator regenerative power.

(C) Disconnecting Means. The disconnecting means required by 620.51 shall disconnect the elevator from both the emergency or standby power system and the normal power system.
Where an additional power source is connected to the load side of the disconnecting means, which allows automatic movement of the car to permit evacuation of passengers, the disconnecting means required in 620.51 shall be provided with an auxiliary contact that is positively opened mechanically, and the opening shall not be solely dependent on springs. This contact shall cause the additional power source to be disconnected from its load when the disconnecting means is in the open position.

ARTICLE 625
Electric Vehicle Charging System

625.27 Requirements for Electrical Vehicle Charging Outlets. New parking spaces provided on a lot when a new building is constructed shall be "EV-ready" as specified in 625.27 (A), (B) or (C). Calculating the number of required EV-ready parking spaces is based on the percentage of occupancy type, any fraction or portion of an EV-ready parking space required shall be rounded up to the nearest whole number.

Exception: The Director may, in consultation with the Director of Seattle City Light, reduce the requirements of this section where there is substantial evidence substantiating that the added electrical load that can be attributed to meeting these requirements will alter the local utility infrastructure design requirements on the utility side of the legal point of service, so as to require on-property power transformation; or require an upgrade to an existing residential electrical service. In these cases, the maximum quantity of EV charging infrastructure required to be installed shall be reduced to the maximum service size that would not require changes to transformation or existing electrical service capacity. The Director may first reduce the required level of EV infrastructure at EV-ready parking spaces from 40-amp to 20-amp circuits. If necessary, the Director may also then reduce the number of required EV-ready parking spaces or otherwise reduce the level of EV infrastructure at EV-ready parking spaces.

(A) Residential uses.

(1) When parking for one- or two-family dwellings is provided in a private garage, carport, or surface parking area, separate from any parking facilities serving other units, at least one parking space for each dwelling unit in that garage, carport, or parking area shall be EV-ready.

(2) When parking for multifamily residential uses is provided in a surface parking area serving multiple residences, the number of parking spaces that shall be EV-ready shall be as follows:

a. For up to 25 required parking spaces, the first 12 shall be EV-ready.

b. When more than 25 parking spaces are provided, 45 percent of all parking spaces shall be EV-ready

(3) When parking for multifamily residential uses is provided in a parking garage serving multiple residences, a minimum of 45 percent of those parking spaces shall be EV-ready.

(B) Nonresidential uses. When parking is provided for nonresidential uses, a minimum of 30 percent of those spaces shall be EV-ready.

Exception: For non-residential occupancies with less than 10 on-site parking spaces, or Group A, E, and M occupancies, at least 10 percent of parking spaces shall be EV-Ready.

(C) Electric vehicle charging infrastructure for accessible parking spaces. Where accessible parking spaces are required, 20 percent of the accessible parking spaces, rounded to the next whole number, shall be EV Ready with no fewer than two EV Ready spaces.

The accessible parking EV Ready infrastructure may also serve adjacent parking spaces not designated as accessible parking. The EV ready accessible parking spaces, rounded to the next whole number, are allowed to be included in the total number of electric vehicle parking spaces required under 625.27(A) &(B).

(D) Electrical room(s) and equipment. Electrical room(s) and electrical equipment shall be sized to accommodate the requirements of Section 625.27. The electrical service and on-site distribution, including transformer(s), shall have sufficient capacity to simultaneously charge all EV's at all EV Ready parking spaces, at a minimum of 208/240 Volt, 40-amperes each (32 amp output).

Exception: An energy management system (EMS) may be used to adjust the maximum electrical capacity required for the EV-Ready parking spaces. The EMS must be designed to allocate charging capacity among multiple future EV charging stations at a minimum of 16 amperes per EV charger.

Informational Note: Automatic load management systems (ALMS) is a term often used to describe energy management systems (EMS).

625.43 Disconnecting means.

((~~For~~)) EVSE and WPTE ((~~rated more than 60 amperes or more than 150 volts to ground, the~~)) disconnecting means shall be labeled as "EV Charger Disconnect" ((~~, provided~~)) and installed in a readily accessible location((~~. If the disconnecting means is installed remote from the ,~~)) in sight and within 25 feet of the EVSE or WPTE equipment. ((~~, a plaque shall be installed on the equipment denoting the location of the disconnecting means. The disconnecting means shall be lockable open in accordance with 110.25.~~))

ARTICLE 645
Information Technology Equipment

645.27 Selective Coordination.
Critical operations data system(s) overcurrent protective devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: When an electrical engineer provides stamped fault current calculations, the overcurrent protective devices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

ARTICLE 680
Swimming Pools, Fountains, and Similar Installations

680.73 Accessibility.
Hydromassage bathtub electrical equipment shall be accessible without damaging the building structure or building finish. Where the hydromassage bathtub is cord- and plug-connected with the supply receptacle accessible only through a service access opening, the receptacle shall be installed so that its face is within direct view and not more than 300 mm (1 ft) of the opening.

The ground fault circuit interrupter device must be identified as to use and not located in a building or tub cavity, crawlspace, or attic.

All electrical equipment installed to support the bathtub (e.g., disconnecting means, motor, etc.) must be accessible at the same grade level as the tub or from a landing on the exterior of the building without the use of a ladder or other access device.

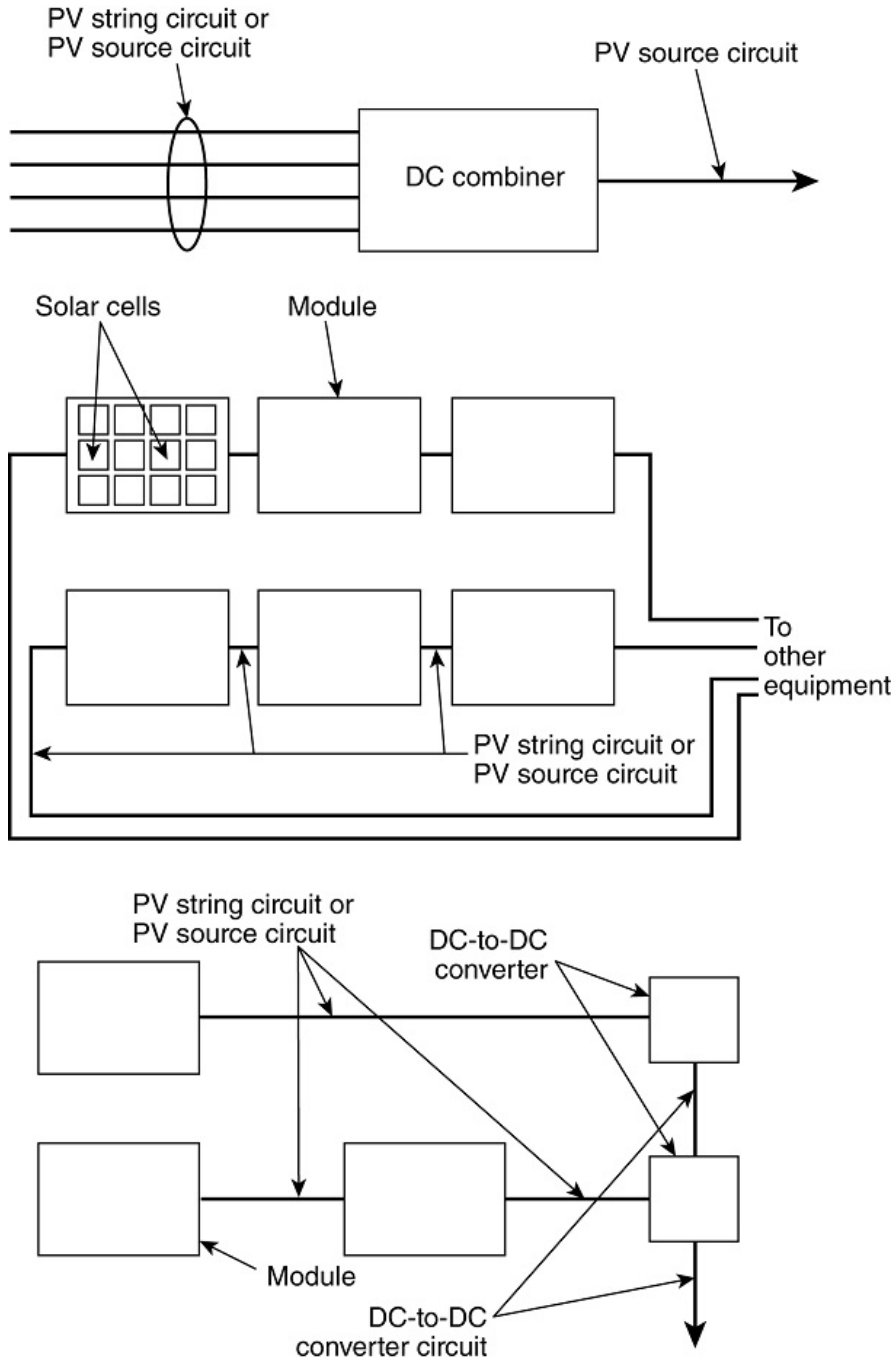
Informational Note: WAC 296-46B-680, requirements for special equipment such as swimming pools, fountains, and similar installations, is incorporated herein with edits.

ARTICLE 690
Solar Photovoltaic (PV) Systems

Δ 690.1 Scope.
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), and controller(s) for such systems. The systems covered by this article include those interactive with other electric power production sources or stand-alone, or both. These PV systems may have ac or dc output for utilization.

Informational Note No. 1 ((~~See Informational Note Figure 690.1~~)). *See Section 80.51(B)(1)(h) of this code for inspection and plan review requirements when installing PV systems.*

Informational Note No. 2: Article 691 covers the installation of large-scale PV electric supply stations.



Informational Note Figure 690.1 Illustration of PV System DC Circuits and PV System Components in a Typical PV Installation.

690.13 Photovoltaic System Disconnecting Means.
Means shall be provided to disconnect the PV system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring.
Δ **(A) Location.**

N **(1) Readily Accessible.** The PV system disconnecting means shall be installed at a readily accessible location.

N **(2) Enclosure Doors and Covers.** Where a disconnecting means for circuits operating above 30 volts is readily accessible to unqualified persons, an enclosure door or hinged cover that exposes energized parts when open shall have its door or cover locked or require a tool to be opened.

(B) Marking. Each PV system disconnecting means shall plainly indicate whether in the open (off) or closed (on) position and be permanently marked "PV SYSTEM DISCONNECT" or equivalent. Additional markings shall be permitted based upon the specific system configuration. For PV system disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING

ELECTRIC SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Δ (C) Maximum Number of Disconnects. Each PV system disconnecting means shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. A single PV system disconnecting means shall be permitted for the combined ac output of one or more inverters or ac modules.

Informational Note: This requirement does not limit the number of PV systems connected to a service as permitted in 690.4(D). This requirement allows up to six disconnecting means to disconnect a single PV system. For PV systems where all power is converted through interactive inverters, a dedicated circuit breaker, in 705.12(B)(1), is an example of a single PV system disconnecting means.

(D) Ratings. The PV system disconnecting means shall have ratings sufficient for the maximum circuit current, available fault current, and voltage that is available at the terminals of the PV system disconnect.

(E) Type of Disconnect. The PV system disconnecting means shall simultaneously disconnect the PV system conductors that are not solidly grounded from all conductors of other wiring systems. The PV system disconnecting means or its remote operating device or the enclosure providing access to the disconnecting means shall be capable of being locked in accordance with 110.25. The PV system disconnecting means shall be one of the following:

(1) A manually operable switch or circuit breaker

(2) A connector meeting the requirements of 690.33(D)(1) or (D)(3)

(3) A pull-out switch with the required interrupting rating

(4) A remote-controlled switch or circuit breaker that is operable locally and opens automatically when control power is interrupted

(5) A device listed or approved for the intended application

Informational Note: Circuit breakers marked "line" and "load" may not be suitable for backfeed or reverse current.

Where the PV system is interactive with other electric power production source(s), and the disconnect is a knife switch, then the PV system disconnect shall comply with the requirements of 404.13(E) and 705.20.

ARTICLE 695
Fire Pumps

Δ 695.3 Power Source(s) for Electric Motor-Driven Fire Pumps. Electric motor-driven fire pumps shall have a reliable source of power.

Informational Note: See NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection*, 9.3.2 and A.9.3.2, for guidance on the determination of power source reliability.

(A) Individual Sources. Where reliable, and where capable of carrying indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply, the power source for an electric motor driven fire pump shall be one or more of the following.

(1) Electric Utility Service Connection. A fire pump shall be permitted to be supplied by a separate service, or from a connection located ahead of and not within the same cabinet, enclosure, vertical switchgear section, or vertical switchboard section as the service disconnecting means. The connection shall be located and arranged so as to minimize the possibility of damage by fire from within the premises and from exposing hazards. A tap ahead of the service disconnecting means shall comply with 230.82(5). The service equipment shall comply with the labeling requirements in 230.2 and the location requirements in 230.72(B). [20:9.2.2(1)]

(2) On-Site Power Production Facility. A fire pump shall be permitted to be supplied by an on-site power production facility. The source facility shall be located and protected to minimize the possibility of damage by fire. [20:9.2.2(3)]

(3) Dedicated Feeder. A dedicated feeder shall be permitted where it is derived from a service connection as described in 695.3(A)(1). [20:9.2.2(3)]

Informational Note: See NFPA 20-2019, Standard for the Installation of Stationary Pumps for Fire Protection, 9.2.2, for more information on normal power sources. Subsection 9.2.2(3) permits a "dedicated feeder" to be derived from a "dedicated service" disconnecting means. Subsection 9.2.2(5) permits a "dedicated transformer connection" that is supplied directly from a "dedicated service disconnecting means" where the service is not at utilization voltage.

(B) Multiple Sources. If reliable power cannot be obtained from a source described in 695.3(A), power shall be supplied by one of the following: [**20:**9.3.2]

(1) Individual Sources. An approved combination of two or more of the sources from 695.3(A).

(2) Individual Source and On-site Standby Generator.
An approved combination of one or more of the sources in 695.3(A) and an on-site standby generator complying with 695.3(D). [**20:**9.3.4]

Exception to 695.3(B)(1) and (B)(2): An alternate source of power shall not be required where a back-up engine-driven fire pump, back-up steam turbine-driven fire pump, or back-up electric motor-driven fire pump with an independent power source in accordance with 695.3(A) or (C) is installed.

(C) Multibuilding Campus-Style Complexes. If the sources in 695.3(A) are not practicable and the installation is part of a multibuilding campus-style complex, feeder sources shall be permitted if approved by the authority having jurisdiction and installed in accordance with either 695.3(C)(1) and (C)(3) or (C)(2) and (C)(3).

(1) Feeder Sources. Two or more feeders shall be permitted as more than one power source if such feeders are connected to, or derived from, separate utility services. The connection(s), overcurrent protective device(s), and disconnecting means for such feeders shall meet the requirements of 695.4(B)(1)(b).

Δ (2) Feeder and Alternate Source. A feeder shall be permitted as a normal power source if an alternate power source independent from the feeder is provided. The connection(s), overcurrent protective device(s), and disconnecting means for such feeders shall meet the requirements of 695.4(B)(1)(b).

(3) Selective Coordination. Overcurrent protective device(s) shall be selectively coordinated with all supply-side overcurrent protective device(s).

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Exception 1: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception 2: When an electrical engineer provides stamped fault current calculations, the overcurrent protective devices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

(D) On-Site Standby Generator as Alternate Source. An on-site standby generator(s) used as an alternate source of power shall comply with **695.3(D)(1)** through (D)(3). [**20:**9.6.2.1]

(1) Capacity. The generator shall have sufficient capacity to allow normal starting and running of the motor(s) driving the fire pump(s) while supplying all other simultaneously operated load(s). [**20:**9.6.1.1]

Automatic shedding of one or more optional standby loads in order to comply with this capacity requirement shall be permitted.

(2) Connection. A tap ahead of the generator disconnecting means shall not be required. [**20:**9.6.1.2]

(3) Adjacent Disconnects. The requirements of 430.113 shall not apply.

(E) Arrangement. All power supplies shall be located and arranged to protect against damage by fire from within the premises and exposing hazards. [**20:**9.1.4]
Multiple power sources shall be arranged so that a fire at one source does not cause an interruption at the other source.

(F) Transfer of Power. Transfer of power to the fire pump controller between the individual source and one alternate source shall take place within the pump room. [**20:**9.6.4]

(G) Power Source Selection. Selection of power source shall be performed by a transfer switch listed for fire pump service. [20:10.8.1.3.1]

(H) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2)(a)(1), provided that it is part of a transfer switch assembly listed for fire pump service that complies with 695.4(B)(2)(a)(2).

(I) Phase Converters. Phase converters shall not be used to supply power to a fire pump. [20:9.1.7]

ARTICLE 700
Emergency Systems

Δ 700.1 Scope.
This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

Informational Note No. 1: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels, theaters, sports arenas, health care facilities, and similar institutions. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and alarm systems, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life safety or health hazards, and similar functions.

Informational Note No. 2: See Article 517, Health Care Facilities, for further information regarding wiring and installation of emergency systems in health care facilities.

Informational Note No. 3: See NFPA 99-2018, Health Care Facilities Code, for further information regarding performance and maintenance of emergency systems in health care facilities.

Informational Note No. 4: See NFPA 101-2018, Life Safety Code, for specification of locations where emergency lighting is considered essential to life safety.

Informational Note No. 5: See NFPA 110-2019, Standard for Emergency and Standby Power Systems, and NFPA 111-2019, Standard on Stored Electrical Energy Emergency and Standby Power Systems, for further information regarding performance of emergency and standby power systems. Emergency systems are considered Level 1 systems when applying NFPA 110.

Informational Note No. 6: See Seattle Building Code Chapter 27 and NFPA 110 and 111 for standards related to emergency power systems for additional installation requirements.

Informational Note No. 7: See Chapter 10 of the Seattle Building Code for means of egress illumination and identification requirements.

Informational Note No. 8: See SDCI TIP 339, Emergency and Standby Power Systems, for additional information

700.3 Tests and Maintenance.
(A) Commissioning Witness Test. The authority having jurisdiction shall conduct or witness the commissioning of the complete system upon installation and periodically afterward.

Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems*

(B) Tested Periodically. Systems shall be tested periodically on a schedule approved by the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

(C) Maintenance. Emergency system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

(D) Written Record. A written record shall be kept of such tests and maintenance.

(E) Testing Under Load. Means for testing all emergency lighting and power systems during maximum anticipated load conditions shall be provided.

Informational Note: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for information on testing and maintenance of emergency power supply systems (EPSSs).

Δ **(F) Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power.** If the emergency system relies on a single alternate source of power, which will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power, which shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources.

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.

(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.

(8) A disconnecting means shall be provided for conductors from where they enter the building to the emergency system. See Section 225.31(B) for location information.

It shall be permissible to use manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to use the switching means for connection of a load bank.

Informational Note: See Informational Note Figure 700.3(F) for one example of many possible methods to achieve the requirements of 700.3(F).

Exception: The permanent switching means to connect a portable or temporary alternate source of power, for the duration of the maintenance or repair, shall not be required where any of the following conditions exists:

(1) *All processes that rely on the emergency system source are capable of being disabled during maintenance or repair of the emergency source of power.*

(2) *The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.*

(3) *Other temporary means can be substituted for the emergency system.*

(4) *A permanent alternate emergency source, such as, but not limited to, a second on-site standby generator or separate electric utility service connection, capable of supporting the emergency system, exists.*

700.7 Signs.

(A) Emergency Sources. A sign shall be placed at the service-entrance equipment, indicating type and location of each on-site emergency power source.

Sign(s) must be placed at the service disconnecting means and the meter base if the services disconnecting means and meter base are not located within sight and within 5 ft of each other.

Exception: A sign shall not be required for individual unit equipment as specified in 700.12(H).

Informational Note: WAC 296-46B-700.007(2), requirements for sign placement, is incorporated herein.

(B) Grounding. Where removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating:

WARNING
SHOCK HAZARD EXISTS IF GROUNDING
ELECTRODE CONDUCTOR OR BONDING
JUMPER CONNECTION IN THIS EQUIPMENT IS
REMOVED WHILE ALTERNATE SOURCE(S) IS
ENERGIZED.

The warning sign(s) or label(s) shall comply with 110.21(B).

700.10 Wiring, Emergency System.
(A) Identification. ((~~Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:~~)) All exit and emergency lights, whether or not required by this *Code*, must be installed in accordance with Article 700.

(1) ((~~All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently marked as a component of an emergency circuit or system so they will be readily identified as a component of an emergency circuit or system.~~)) All boxes and enclosures, for Article 700 systems, larger than 6 in. by 6 in., including transfer switches, generators, and power panels for emergency systems and circuits, must be permanently identified *with* an identification plate that is substantially orange in color. All other device and junction boxes for emergency systems and circuits must be substantially orange in color, both inside and outside.

Exception: In existing health care facilities, the existing nameplate identification color scheme can be retained for transfer switches, generators, and power panels for existing emergency systems that are not being replaced or modified.

Informational Note: WAC 296-46B-700.009(3) and (4), requirements for emergency and exit lights, and identification plates, are incorporated herein.

(2) Where boxes or enclosures are not encountered, exposed cable or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, at intervals not to exceed 7.6 m (25 ft).

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle cover plates or the receptacles.

Δ **(B) Wiring.** Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment unless otherwise permitted in the following:
(1) Wiring from the normal power source located in transfer equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

(3) Wiring from two sources in a listed load control relay supplying exit or emergency luminaires, or in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring within a traveling cable to an elevator
(6) Wiring from an emergency source to supply emergency and other (nonemergency) loads in accordance with the following:

a. Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.

b. The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:

(i) Supplied by single or multiple feeders without overcurrent protection at the source

(ii) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

Informational Note: See Informational Note Figure 700.10(B)(1) and Informational Note Figure 700.10(B)(2) in the NEC for further information.

c. Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as other circuits.

d. It shall be permissible to use single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

e. At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

(C) Wiring Design and Location. Emergency wiring circuits shall be designed and located so as to minimize the hazards that might cause failure due to flooding, fire, icing, vandalism, and other adverse conditions.

(D) Fire Protection.

(1) Occupancies. Emergency systems shall meet the additional requirements in 700.10(D)(2) through (D)(4) in the following occupancies:

(1) Assembly occupancies for not less than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(3) Educational occupancies with more than 300 occupants

Δ (2) Feeder-Circuit Wiring. Feeder-circuit wiring shall meet one of the following conditions:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire protection system.

Informational Note: In buildings having *Seattle Building Code* Type I or II construction, wiring located above fire protection sprinklers, including wiring separated from fire protection sprinklers by a suspended ceiling system with removable panels, is considered fully protected as required by this section.

(2) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

Informational Note No. 1: See UL 1724, Fire Tests for Electrical Circuit Protection Systems, for one method of defining an electrical circuit protective system. The UL Guide Information for Electrical Circuit Integrity Systems (FHIT) contains information to identify the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating and is available from the certification body.

(3) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

(4) Informational Note No. 2: See UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for one method of defining a fire-resistive cable system.

(5) The cable or raceway is protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency circuits.

(6) The cable or raceway is encased in a minimum of 50 mm (2 in.) of concrete.

(3) Feeder-Circuit Equipment. Equipment for feeder circuits (including transfer switches, transformers, and panelboards) shall be located either in spaces fully protected by an approved automatic fire protection system or in spaces with a 2-hour fire resistance rating.

(4) Source Control Wiring. Control conductors installed between the emergency power supply system/stored-energy power supply system (EPSS/SEPSS) and transfer equipment or control systems that initiate the operation of emergency sources or initiate the automatic connection to emergency loads shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(2). The integrity of source control wiring shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall result in the following actions:

(1) *Generators*. Shall start the generator(s).

(2) *All other sources*. Shall be considered a system malfunction and initiate the designated signal(s) in 700.6(A).

***N* 700.11 Wiring, Class-2-Powered Emergency Lighting Systems.**

***N* (A) General.** Line voltage supply wiring and installation of Class 2 emergency lighting control devices shall comply with 700.10. Class 2 emergency circuits shall comply with 700.11(B) through (D).

***N* (B) Identification.** Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures for Class 2 emergency circuits larger than 6 in. by 6 in. shall be permanently ((~~marked as a component of an emergency circuit or system so they will be readily~~)) identified with an identification plate

that is substantially orange in color. All other device and junction boxes for emergency systems and circuits must be substantially orange in color, both inside and outside.

(2) Exposed cable, cable tray, or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, within 900 mm (3 ft) of each connector and at intervals not to exceed 7.6 m (25 ft).

N **(C) Separation of Circuits.** Class 2 emergency circuits shall be wired in a listed, jacketed cable or with one of the wiring methods of Chapter 3. If installed alongside nonemergency Class 2 circuits that are bundled, Class 2 emergency circuits shall be bundled separately. If installed alongside nonemergency Class 2 circuits that are not bundled, Class 2 emergency circuits shall be separated by a nonconductive sleeve or nonconductive barrier from all other Class 2 circuits. Separation from other circuits shall comply with 725.136.

N **(D) Protection.** Wiring shall comply with the requirements of 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

Exception No. 1: Section 700.11(D) shall not apply to wiring that does not exceed 1.83 m (6 ft) in length and that terminates at an emergency luminaire or an emergency lighting control device.

Exception No. 2: Section 700.11(D) shall not apply to locked rooms or locked enclosures that are accessible only to qualified persons.

Informational Note: Locked rooms accessible only to qualified persons include locked telecommunications rooms, locked electrical equipment rooms, or other access-controlled areas.

700.12 General Requirements.
Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(C) through (H). Unit equipment in accordance with 700.12(H) shall satisfy the applicable requirements of this article.

(A) Power Source Considerations. In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building.

Δ (B) Equipment Design and Location. Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism.
Equipment for sources of power as described in 700.12(C) through (H) shall be installed either in spaces fully protected by approved automatic fire protection systems or in spaces with a 2-hour fire rating where located within the following:

(1) Assembly occupancies for more than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(3) Educational occupancies with more than 300 occupants

Informational Note No. 1: ((~~See NFPA 101-2021, Life Safety Code, Section 6.1, for information on occupancy classifications.~~)) For the definition of *Occupancy Classification*, see Chapter 3 of the *Seattle Building Code*.

Informational Note No. 2: See IEEE 3006.5-2014, Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems, for information regarding power system reliability.

Δ (C) Supply Duration. The emergency power source shall be of suitable rating and capacity to supply and maintain the total load for the duration determined by the system design. In no case shall the duration be less than 2 hours of system operation unless used for emergency illumination in 700.12(C)(4) or unit equipment in 700.12(H). Additionally, the power source shall comply with 700.12(C)(1) through (C)(5) as applicable.

Informational Note: See NFPA 110-2022, Standard for Emergency and Standby Power Systems, for information on classification of emergency power supply systems (EPSS).

N **(1) On-Site Fuel Supply.** An on-site fuel supply shall be provided, sufficient for not less than 2 hours operation of the system.

N **(2) Fuel Transfer Pumps.** Where power is needed for the operation of the fuel transfer pumps to deliver fuel to the source, these pumps shall be connected to the emergency power system.

N **(3) Public Gas System, Municipal Water Supply.** Sources shall not be solely dependent on a public utility gas system for their fuel supply or municipal water supply for their cooling systems.

((~~Exception: Where approved by the authority having jurisdiction, the use of other than on-site fuels shall be permitted where there is a low probability of a simultaneous failure of both the off-site fuel delivery system and power from the outside electrical utility company. Where the public gas system is approved, the requirements of 700.12(C)(1) shall not apply.~~))

N **(4) Storage Batteries and UPS.** Storage batteries and UPS used to supply emergency illumination shall be of suitable rating and capacity to supply and maintain the total load for a minimum period of 1½ hours, without the voltage applied to the load falling below 87½ percent of nominal voltage. Automotive-type batteries shall not be used. An automatic battery charging means shall be provided.

N **(5) Automatic Fuel Transfer**. Where dual fuel sources are used, means shall be provided for automatically transferring from one fuel source to another.

(D) Generator Set.

(1) Prime Mover-Driven. For a generator set driven by a prime mover approved by the authority having jurisdiction and sized in accordance with 700.4, means shall be provided for automatically starting the prime mover on failure of the normal power source and for automatic transfer and operation of all required electrical circuits. A time-delay feature shall be provided to avoid retransfer in case of short-time reestablishment of the normal source.

(2) Battery Power and Dampers. Where a storage battery is used for control or signal power or as the means of starting the prime mover, it shall be suitable for the purpose and shall be equipped with an automatic charging means independent of the generator set. Where the battery charger is required for the operation of the generator set, it shall be connected to the emergency system. Where power is required for the operation of dampers used to ventilate the generator set, the dampers shall be connected to the emergency system.

(3) Auxiliary Power Supply. Generator sets that require more than 10 seconds to develop power shall be permitted if an auxiliary power supply energizes the emergency system until the generator can pick up the load.

(4) Outdoor Generator Sets. Where an outdoor-housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.

Exception: For installations under single management, where conditions of maintenance and supervision ensure that only qualified persons will monitor and service the installation and where documented safe switching procedures are established and maintained for disconnection, the generator set disconnecting means shall not be required to be located within sight of the building or structure served.

Δ **(E) Stored-Energy Power Supply Systems (SEPSS).** Stored energy power supply systems shall comply with 700.12(E)(1) and (E)(2) and shall be listed for emergency use.

N **(1) Types.** Systems shall consist of one or more of the following system types:

(1) Uninterruptible power supply (UPS)

Informational Note: See UL 1778, Uninterruptible Power Systems and UL 924 *Emergency Lighting and Power Equipment*, for further information.

(2) Fuel cell system

(3) Energy storage system (ESS)

(4) Storage battery

(5) Other approved equivalent stored energy sources that comply with 700.12

N **(2) Fire Protection, Suppression, Ventilation, and Separation.** The systems in 700.12(E)(1) shall be installed with the fire protection, suppression, ventilation, and separation requirements specified in the manufacturer's instructions or equipment listing.

Informational Note: See NFPA 853-2020, Standard for the Installation of Stationary Fuel Cell Power Systems, and NFPA 855-2020, Standard for the Installation of Stationary Energy Storage Systems, for additional information on fire protection installation requirements.

(F) Separate Service. Where approved by the authority having jurisdiction as suitable for use as an emergency source of power, an additional service shall be permitted. This service shall be in accordance with the applicable provisions of Article 230 and the following additional requirements:

(1) Separate ((~~overhead service conductors,~~)) service drops, underground service conductors, or service laterals shall be installed.

(2) The service conductors for the separate service shall be installed sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply.

Δ (G) Microgrid Systems. On-site sources, designated as emergency sources, shall be permitted to be connected to a microgrid system.

The system shall isolate the emergency system from all nonemergency loads when the normal electric supply is interrupted or shall meet the requirements of 700.4(B). Interruption or partial or complete failure of the normal or nonemergency source(s) shall not impact the availability, capacity, and duration provided by the designated emergency sources.

The designated stored-energy electrical emergency power source(s) of a microgrid system shall be permitted to remain interconnected to any available power production source during operation of the emergency source(s) where the lack of, or failure of, the interconnected power production source(s), or related controls, does not impact system operation. Interconnected power production sources, other than the designated stored emergency power source(s), shall not be required to meet the requirements of this article.

(H) Battery-Equipped Emergency Luminaires.

Δ (1) Listing. All battery-equipped emergency luminaires shall be listed.

Informational Note No. 1: See ANSI/UL 924, Emergency Lighting and Power Equipment, for the requirements covering battery-equipped emergency luminaires and emergency battery packs. A listed emergency battery pack installed in a listed luminaire will provide similar functionality as a listed battery-equipped emergency luminaire.

Informational Note No. 2: Unit equipment is a type of battery-equipped emergency luminaire.

Δ (2) Installation. Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:
   a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

   b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

   c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

700.16 Emergency Illumination.
(A) General. Emergency illumination shall include means of egress lighting, illuminated exit signs, and all other luminaires specified as necessary to provide required illumination.

Δ (B) System Reliability. Emergency lighting systems shall be designed and installed so that the failure of any illumination source, or branch circuit supplying an illumination source, cannot leave in total darkness any space that requires emergency illumination. Emergency lighting control devices in the emergency lighting system shall be listed for use in emergency systems. Listed unit equipment in accordance with 700.12(H) shall be considered as meeting the provisions of this section.

Informational Note: See 700.23 through 700.26 for applications of emergency system control devices.

(C) Discharge Lighting. Where high-intensity discharge lighting such as high- and low-pressure sodium, mercury vapor, and metal halide is used as the sole source of normal illumination, the emergency lighting system shall be required to operate until normal illumination has been restored.

(D) Disconnecting Means. Where an emergency system is installed, emergency illumination shall be provided in the area of the disconnecting means required by 225.31 and 230.70, as applicable, where the disconnecting means are installed indoors.

(a) Exit signs with open bottom lighting shall not be used in lieu of a required pathway light unless specifically approved for the purpose.

(b) Exit illumination (pathway lighting) and emergency area lighting shall comply with Chapter 10 of the Seattle Building Code.

Exception: Alternative means that ensure that the emergency lighting illumination level is maintained shall be permitted when preapproved by the authority having jurisdiction.

Δ 700.17 Branch Circuits for Emergency Lighting.
Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when the normal supply for lighting is interrupted. Such installations shall provide either of the following, so that the failure of any branch circuit supplying an illumination source cannot leave in total darkness any space that requires emergency illumination:

(1) An emergency lighting supply, independent of the normal lighting supply, with provisions for automatically transferring the emergency lights upon the event of failure of the normal lighting supply.

(2) Two or more branch circuits supplied from separate and complete systems with independent power sources. One of the two power sources and systems shall be part of the emergency system, and the other shall be permitted to be part of the normal power source and system. Each system shall provide sufficient power for emergency lighting purposes.

Unless both systems are used for regular lighting purposes and both are kept lighted, means shall be provided for automatically energizing either system upon failure of the other. Either system or both systems shall be permitted to be a part of the general lighting of the protected occupancy if circuits supplying lights for emergency illumination are installed in accordance with other sections of this article.

Δ 700.32 Selective Coordination.

N **(A) General**. Emergency overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

N **(B) Replacements.** Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

Δ (C) Modifications. If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

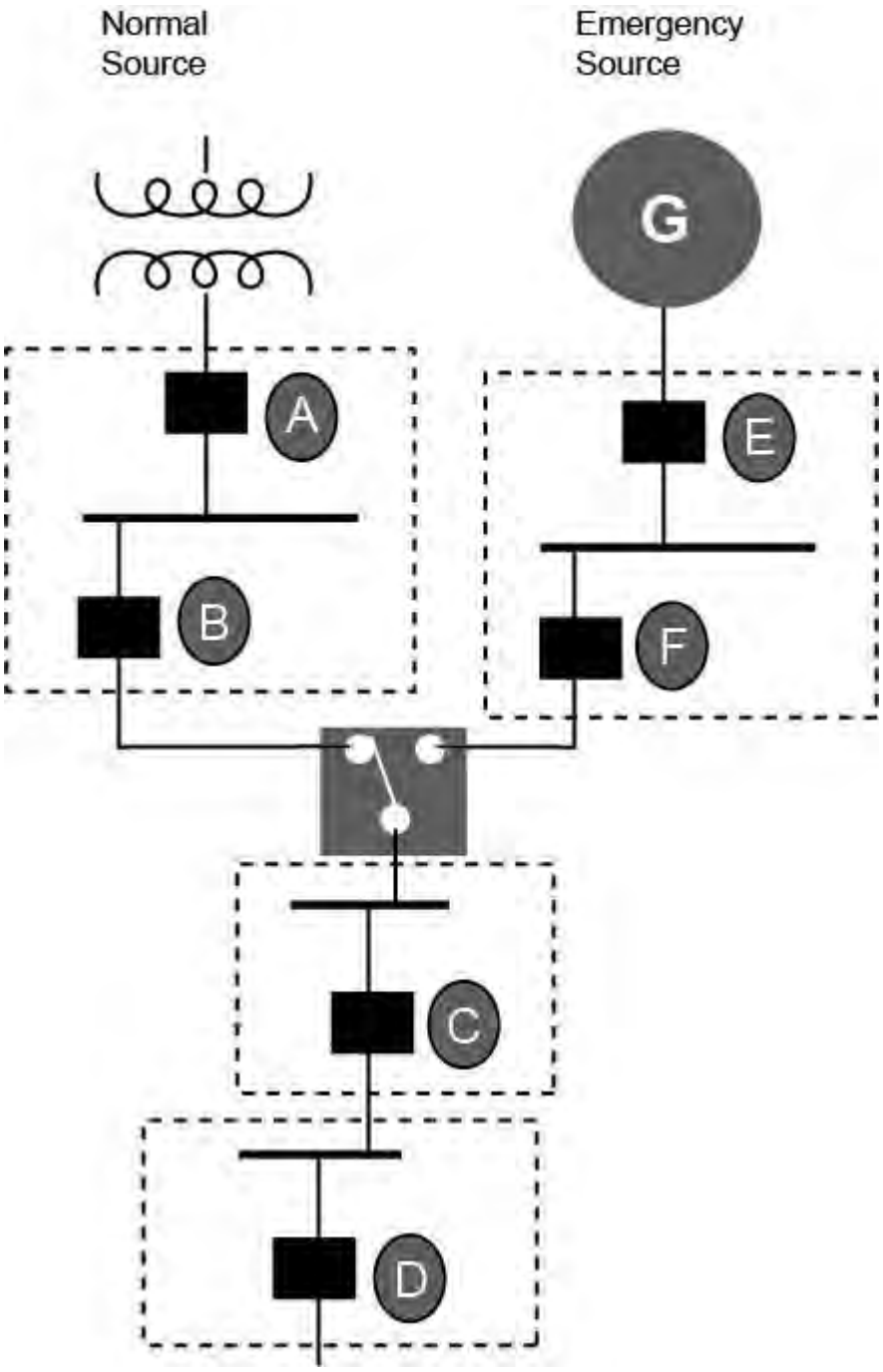
Exception No. 1: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception No. 2: When an electrical engineer provides stamped and signed time current curves, the overcurrent protective devices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

Exception No. 3 to (A), (B) and (C): Selective coordination shall not be required for emergency overcurrent protective devices installed prior to June 1, 2006.

Informational Note: The requirements of WAC 296-46B-700.032 are incorporated herein with edits.

Informational Note: See Informational Note Figure 700.32 for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.



Informational Note Figure 700.32 Emergency System Selective Coordination. OCPD D selectively coordinates with OCPDs C, F, E, B, and A. OCPD C selectively coordinates with OCPDs F, E, B, and A. OCPD F selectively coordinates with OCPD E. OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

ARTICLE 701
Legally Required Standby Systems

Δ 701.32 Selective Coordination.
***N* (A) General**. Legally required standby system(s) overcurrent protective devices (OCPDs shall be selectively coordinated with all supply-side and load-side OCPDs.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

***N* (B) Replacements.** Where legally required standby OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

Δ (C) Modifications. If modifications, additions, or deletions to the legally required standby system(s) occur, selective coordination of the legally required system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

Exception No. 1: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception No. 2: When an electrical engineer provides stamped and signed time current curves, the overcurrent protective devices in each disconnecting means may be selectively coordinated with any other supply side overcurrent protective devices for faults with a duration of 0.1 seconds and longer.

Exception No. 3 to (A), (B) and (C):Selective coordination shall not be required for legally required standby overcurrent protective devices installed prior to June 1, 2006.

Informational Note: The requirements of WAC 296-46B-701.032 are incorporated herein with edits.

Informational Note: See Informational Note Figure 701.32 for an example of how legally required standby system OCPDs selectively coordinate with all supply-side OCPDs.

ARTICLE 702
Optional Standby Systems

702.7 Signs.

Δ **(A) Standby.** A sign shall be placed at the service equipment for other than one- and two-family dwellings that indicates the type and location of each on-site optional standby power source. For one- and two-family dwelling units, a sign shall be placed at the disconnecting means required in 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect or means to shut down the prime mover as required in 445.19(C).

The sign(s) required in this section must be placed where required and at the meter base if the meter base is not located within sight and within five feet of where the sign is required. When a disconnecting means required by NEC 230.85 is not present, the sign(s) required in this section must be placed at the service disconnecting means and the meter base if the service disconnecting means and the meter base are not located within sight and within five feet of each other.

Informational note: the requirements of WAC 296-46B-702 007 are incorporated herein with edits

Δ (B) Grounding. Where removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating:

WARNING:
SHOCK HAZARD EXISTS IF GROUNDING
ELECTRODE CONDUCTOR OR BONDING JUMPER
CONNECTION IN THIS EQUIPMENT IS REMOVED
WHILE ALTERNATE SOURCE(S) IS ENERGIZED.

The warning sign(s) or label(s) shall comply with 110.21(B).

Δ (C) Power Inlet. Where a power inlet is used for a temporary connection to a portable generator, a warning sign shall be placed near the inlet to indicate the type of derived system that the system is capable of based on the wiring of the transfer equipment. The sign shall display one of the following warnings:

WARNING:
FOR CONNECTION OF A SEPARATELY DERIVED (BONDED NEUTRAL) SYSTEM ONLY

or
WARNING:
FOR CONNECTION OF A NONSEPARATELY DERIVED (FLOATING NEUTRAL) SYSTEM ONLY

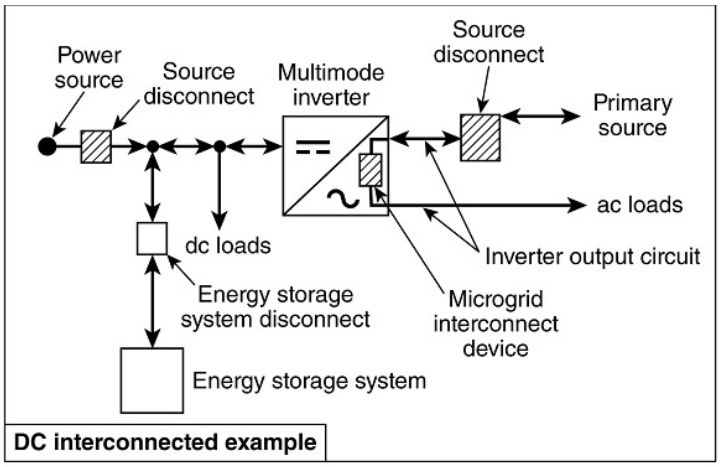
ARTICLE 705
Interconnected Electric Power Production Sources

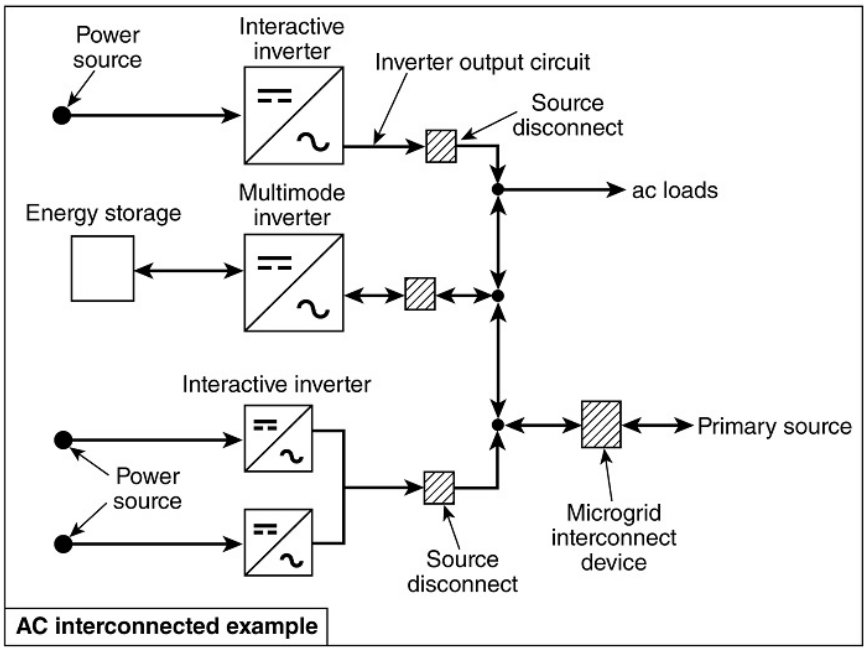
Δ 705.1 ((~~Scope~~)) General.

(A) Scope. This article covers installation of one or more electric power production sources operating in parallel with a primary source(s) of electricity.

Informational Note No. 1: Examples of the types of primary sources include a utility supply or an on-site electric power source(s).

Informational Note No. 2: See **Informational Note Figure 705.1**.





Notes:
(1) These diagrams are intended to be a means of identification for power source components, circuits, and connections.
(2) The power source disconnect in these diagrams separates the power source from other systems.
(3) Equipment disconnecting means not shown.
(4) System grounding and equipment grounding are not shown.
(5) Custom designs occur in each configuration, and some components are optional.

N **Informational Note Figure 705.1** Identification of Power Source Components in Common Configurations

(B) Utility Requirements. The serving utility shall be consulted by the owner, the owner's agent, or the contractor making the installation to ensure compliance with the requirements of the utility.

Informational Note No. 1: See Seattle City Light's *Requirements for Electrical Service Connection* for information on specific utility requirements.

Informational Note No. 2: The requirements of WAC 296-46B-705 (1) are incorporated herein with edits.

Δ 705.11 Source Connections to a Service.

N **(A) Service Connections.** An electric power production source shall be permitted to be connected to a service by one of the following methods:

(1) To a new service in accordance with 230.2(A)

(2) To the supply side of the service disconnecting means in accordance with 230.82(6)

(3) To an additional set of service entrance conductors in accordance with 230.40, Exception No. 5
These connections shall comply with 705.11(B) through (F).

Δ (B) Conductors. Service conductors connected to power production sources shall comply with the following:

(1) The ampacity of the service conductors connected to the power production source service disconnecting means shall not be less than the sum of the power production source maximum circuit current in 705.28(A).
(2) The service conductors connected to the power production source service disconnecting means shall be sized in accordance with 705.28 and not be smaller than 6 AWG copper or 4 AWG aluminum or copper-clad aluminum.
(3) The ampacity of any other service conductors to which the power production sources are connected shall not be less than that required in 705.11(B).

(C) Connections. Connections to service conductors or equipment shall comply with 705.11(C)(1) through (C)(3).

N **(1) Splices or Taps.** Service conductor splices and taps shall be made in accordance with 230.33 or 230.46 and comply with all applicable enclosure fill requirements.

N **(2) Existing Equipment.** Any modifications to existing equipment shall be made in accordance with the manufacturer's instructions, or the modification must be field evaluated for the application and be field labeled.

N **(3) Utility-Controlled Equipment.** For meter socket enclosures or other equipment under the exclusive control of the electric utility, only connections approved by the electric utility shall be permitted.

N **(D) Service Disconnecting Means.** A disconnecting means in accordance with Parts VI through VII of Article 230 shall be provided to disconnect all ungrounded conductors of a power production source from the conductors of other systems. The disconnecting means providing overcurrent protection for the electric power production source conductors must comply with NEC 230.82(6). This disconnect is not required to be grouped with the service disconnecting means for the building or structure. Grounding and bonding must be in accordance with NEC 250.25.

N **(E) Bonding and Grounding.** All metal enclosures, metal wiring methods, and metal parts associated with the service connected to a power production source shall be bonded in accordance with Parts II through V and VIII of Article 250.

Δ (F) Overcurrent Protection. The power production source service conductors shall be protected from overcurrent in accordance with Part VII of Article 230. The rating of the overcurrent protection device of the power production source service disconnecting means shall be used to determine if ground-fault protection of equipment is required in accordance with 230.95.

(G) Wiring methods. Electric power production source conductors connected to the supply side of the service disconnecting means must be installed using wiring methods specified for service conductors in Seattle Electrical Code 230.43.

Informational Note: The requirements of WAC-296-46B-705 011(2) are incorporated herein with edits

Δ 705.12 Load-Side Source Connections.
The output of an interconnected electric power source shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any distribution equipment on the premises. Where distribution equipment or feeders are fed simultaneously by a primary source of electricity and one or more other power source(s), the feeders or distribution equipment shall comply with relevant sections of 705.12(A) and (B). Currents from power source connections to feeders or busbars shall be based on the maximum circuit currents calculated in 705.28(A). The ampacity of feeders and taps shall comply with 705.12(A), and the ampere ratings of busbars shall comply with 705.12(B).

(A) Feeders and Feeder Taps. Where the power source output connection is made to a feeder, the following shall apply:

(1) The feeder ampacity is greater than or equal to 125 percent of the power-source output circuit current.

(2) Where the power-source output connection is made at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

a. The feeder ampacity shall be not less than the sum of the rating of the primary source overcurrent device and 125 percent of the power-source output circuit current.
b. An overcurrent device at the load side of the power source connection point shall be rated not greater than the ampacity of the feeder.

(3) For taps sized in accordance with 240.21(B)(2) or (B)(4), the ampacity of taps conductors shall not be less than one-third of the sum of the rating of the overcurrent device protecting the feeder plus the ratings of any power source overcurrent devices connected to the feeder.

(B) Busbars. For power source connections to distribution equipment with no specific listing and instructions for combining multiple sources, one of the following methods shall be used to determine the required ampere ratings of busbars:

(1) The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the busbar ampere rating.

Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

(2) Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power-source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the busbar ampere rating. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

WARNING:
POWER SOURCE OUTPUTDO NOT RELOCATE THIS OVERCURRENT DEVICE.

The warning sign(s) or label(s) shall comply with 110.21(B).

(3) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording:

WARNING:
EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR.

The warning sign(s) or label(s) shall comply with 110.21(B).

(4) A connection at either end of a center-fed panelboard in dwellings shall be permitted where the sum of 125 percent of the power-source(s) output circuit current and the rating of the overcurrent device protecting the busbar does not exceed 120 percent of the busbar ampere rating.

(5) Connections shall be permitted on busbars of panelboards that supply lugs connected to feed-through conductors or are supplied by feed-through conductors. The feed-through conductors. The feed-through conductors shall be sized in accordance with 705.12(A). Where an overcurrent device is installed at either end of the feed-through conductors, panelboard busbars on either side of the feed-through conductors shall be permitted to be sized in accordance with 705.12(B)(1) through (B)(3).

(6) Connections shall be permitted on switchgear, switchboards, and panelboards in configurations other than those permitted in 705.12(B)(1) through (B)(5) where designed under engineering supervision that includes available fault-current and busbar load calculations.

Informational Note: Specifically designed equipment exists, listed to UL 1741, *Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources*, for the combination and distribution of sources to supply loads. The options provided in 705.12(B) are for equipment with no specific listing for combining sources.

CHAPTER 1 [CE]

SCOPE AND ADMINISTRATION

(Chapter 1 consists entirely of Seattle amendments and is not underlined)

SECTION C101
SCOPE AND GENERAL REQUIREMENTS

C101.1 Title. This code, consisting of Chapter 1 [CE] through Chapter 6 [CE] and Appendices A through D, shall be known as the "Seattle Commercial Energy Code," and shall be cited as such. It is referred to herein as "this code."

C101.2 Scope. This code applies to *commercial buildings* and the buildings sites and associated systems and equipment. References in this code to Group R shall include Group I-1, Condition 2 assisted living facilities licensed by Washington state under chapter 388-78A WAC and Group I-1, Condition 2 residential treatment facilities licensed by Washington state under Chapter 246-337 WAC. Building areas that contain Group R sleeping units, regardless of the number of stories in height, are required to comply with the commercial sections of the energy code.

Exception: The provisions of this code do not apply to *temporary growing structures* used solely for the commercial production of horticultural plants including ornamental plants, flowers, vegetables, and fruits. A temporary growing structure is not considered a building for the purposes of this code. However, the installation of other than listed, portable mechanical equipment or listed, portable lighting fixtures is not allowed.

C101.3 Intent. This code shall regulate the design and construction of buildings for the use and conservation of energy and the reduction of carbon emissions over the life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

C101.4.1 Mixed residential and commercial buildings. Where a building includes both *residential building* and *commercial building* portions, each portion shall be separately considered and meet the applicable provisions of the Seattle Energy Code—Commercial Provisions or the Seattle Energy Code—Residential Provisions.

C101.5 Compliance. *Residential buildings* shall meet the provisions of the Seattle Energy Code—Residential Provisions. *Commercial buildings* shall meet the provisions of the Seattle Energy Code—Commercial Provisions.

C101.5.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

C101.6 Appendices. Appendices A, B, C and D are included in the adoption of this code. Provisions in appendices E and F shall not apply unless specifically adopted by the local jurisdiction. Appendices E and F are not adopted in the Seattle Energy Code.

C101.7 Vesting of initial tenant improvements. The initial tenant improvements of spaces within a building are permitted to comply with the codes applicable to the base building, if the permit applications are submitted within the 18-month timeframe specified in Section 101.3.2 of the Seattle Building Code.

SECTION C102
ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT

C102.1 General. The provisions of this code do not prevent the installation of any material, or prohibit any design or method of construction prohibited by this code or not specifically allowed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *code official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the *code official* shall respond in writing, stating the reasons why the alternative was not approved.

The *code official* may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The *code official* may, but is not required to, record the approval of modifications and any relevant information in the files of the building official or on the *approved* permit plans.

C102.2 Modifications. The *code official* may modify the requirements of this code for individual cases provided the *code official* finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; (3) the modification will provide a reasonable level of fire protection and structural integrity when considered together with other safety features of the building or other relevant circumstances, and (4) the modification maintains or improves the energy efficiency of the building. The *code official* may, but is not required to, record the approval of modifications and any relevant information in the files of the *code official* or on the *approved* permit plans.

SECTION C103
APPLICATIONS AND PERMITS

C103.1 General. A permit for work performed according to this code shall be obtained in accordance with Chapter 1 of the International Building Code, International Mechanical Code or Seattle Electrical Code.

C103.2 Construction documents. Construction documents and other supporting data shall comply with this section and the International Building Code, International Mechanical Code, International Existing Building Code and Seattle Electrical Code.

C103.2.1 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and SHGCs.
3. Area-weighted *U*-factor and SHGC calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating system and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and systems controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight zones* on floor plan.
12. *Air barrier* details including all *air barrier* boundaries and associated square foot calculations on all six sides of the *air barrier* as applicable.
13. Applicable code edition and date of building permit application.
14. Energy code compliance pathway selected according to Section C401.2.
15. For projects complying with the Prescriptive Path in accordance with Section C401.2, Item 1, a list of all the selected additional energy credits and load management measure credits, to be shown on architectural permit documents, plus applicable additional energy credits and load management measure credits on mechanical, plumbing, boiler, electrical and lighting permit documents.

C103.2.2 Building thermal envelope depiction. The building's thermal envelope shall be represented on the construction documents.

C103.2.3 Document retention. One set of reviewed and *approved* construction documents shall be retained by the *code official*. The other set shall be returned to the applicant, kept at the site of work and shall be open to inspection by the *code official* or a duly authorized representative.

C103.3—C103.5 (Reserved)

C103.6 Building documentation and close out submittal requirements. The construction documents shall specify that the documents described in this section be provided to the building owner or owner's authorized agent within a maximum of 90 days of the date of receipt of the certificate of occupancy.

C103.6.1 Record documents. Construction documents shall be updated by the installing contractor and architect or engineer of record to convey a record of the completed work. Such updates shall include building envelope, mechanical, plumbing, electrical and control drawings red-lined, or redrawn, that show all changes to size, type and locations of components, equipment and assemblies. Record documents shall include the location and model number of each piece of

equipment as installed. The architect, engineer of record or installing contractor is required to provide consolidated record drawings in compliance with this section to the building owner or owner's authorized agent with the timeline specified in Section C103.6.

C103.6.2 Building operations and maintenance information. Required regular maintenance actions for equipment and systems shall be clearly stated on a readily visible label on the equipment. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product and the manufacture date or installation date.

C103.6.2.1 Manuals. An operating and maintenance manual shall be provided for each component, device, piece of equipment, and system governed by this code. The manual shall include all of the following:

1. Submittal data indicating all selected options for each piece of equipment and control device.
2. Manufacturer's operation manuals and maintenance manuals for each device, piece of equipment, and system requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions, cleaning and recommended relamping shall be clearly identified.
3. Name and address of at least one service agency.
4. Controls system inspection schedule, maintenance and calibration information, wiring diagrams, schematics, and control sequence descriptions. A schedule for inspecting and recalibrating all lighting controls. Desired or field-determined set points shall be PERMANENTLY recorded on control drawings at control devices or, for digital control systems, on the graphic where settings may be changed.
5. A narrative of how each system is intended to operate, including recommended set points. Sequence of operation alone is not acceptable for this requirement.

C103.6.3 Compliance documentation. All energy code compliance forms and calculations shall be delivered in one document to the building owner as part of the project record documents or manuals, or as a standalone document. This document shall include the specific energy code year utilized for compliance determination for each system, NFRC certificates for the installed windows, list of total area for each NFRC certificate, and the interior lighting power compliance path (building area, space-by-space) used to calculate the lighting power allowance.

For projects complying with Section C401.2 item 1, the documentation shall include:

1. The envelope insulation compliance path (prescriptive or component performance).
2. All required completed code compliance forms, and all required compliance calculations

For projects complying with Section C402.2, item 2, the documentation shall include:

1. A list of all proposed envelope component types, areas and *U*-values.
2. A list of all lighting area types with areas, lighting power allowance, and installed lighting power density.
3. A list of each HVAC system modeled with the assigned and proposed system type.
4. Electronic copies of the baseline and proposed model input and output file. The input files shall be in a format suitable for rerunning the model and shall not consist solely of formatted reports of the inputs.

C103.6.4 Systems operation training. Training of the maintenance staff for equipment included in the manuals required by Section C103.6.2 shall include at a minimum:

1. Review of manuals and permanent certificate.
2. Hands-on demonstration of all normal maintenance procedures, normal operating modes, and all emergency shut-down and start-up procedures.
3. Training completion report.

SECTION C104
INSPECTIONS

C104.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official*, his or her designated agent, or an *approved* agency, in accordance with this section and the International Building Code, International Mechanical Code and Seattle Electrical Code, and such construction or work shall remain visible and able to be accessed for inspection purposes until *approved*. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain visible and able to be accessed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

C104.2 Required inspections. The *code official*, his or her designated agent, or an *approved agency*, upon notification, shall make the inspections set forth in Sections C104.2.1 through C104.2.6.

C104.2.1 Footing and foundation insulation. Inspections shall verify footing and/or foundation insulation *R*-value, location, thickness, depth of burial and protection of insulation as required by the code, *approved* plans and specifications.

C104.2.2 Thermal envelope. Inspections shall be made before application of interior finish and shall verify that envelope components with the correct type of insulation, the R-values, the correct location of insulation, the correct fenestration, the U-factor, SHGC, VT, and air leakage controls are properly installed as required by the code, *approved* plans and specifications, including envelope components in future tenant spaces of multi-tenant buildings.

C104.2.3 Plumbing system. Inspections shall verify the type of insulation, the R-values, the protection required, controls, and heat traps as required by the code, *approved* plans and specifications.

C104.2.4 Mechanical system. Inspections shall verify the installed HVAC equipment for the correct type and size, controls, duct and piping insulation *R*-values, *duct system* and damper air leakage, minimum fan efficiency, energy recovery and economizer as required by the code, *approved* plans and specifications.

C104.2.5 Electrical system. Inspections shall verify lighting system controls, components, meters; motors and installation of an electric meter for each *dwelling unit* as required by the code, approved plans and specifications.

C104.2.6 Final inspection. The final inspection shall include verification of the installation and proper operation of all required building controls, and documentation verifying activities associated with required *building commissioning* have been conducted in accordance with Section C408.

C104.3 Reinspection. A building shall be reinspected when determined necessary by the *code official*.

C104.4 Approved inspection agencies. The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability relevant to the building components and systems they are inspecting.

C104.5 Inspection requests. It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

C104.6 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.

SECTION C105
VALIDITY

C105.1 General. If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code.

SECTION C106
REFERENCED STANDARDS

C106.1 Referenced codes and standards. The codes and standards referenced in this code shall be those listed in Chapter 6, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections C106.1.1 and C106.1.2.

C106.1.1 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, which includes local amendments. References to the "Building Code," "Residential Code," "Fire Code," "Electrical Code," "Mechanical Code" and "Plumbing Code" mean the Seattle editions of those codes.

C106.1.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

C106.2 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

C106.3 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law. In the case of conflict between the duct sealing and insulation requirements of this code and the requirements of Sections 603 and 604 of the *International Mechanical Code*, the requirements of this code shall govern.

SECTION C107
FEES

C107.1 Fees. A fee for each permit and for other activities related to the enforcement of this code shall be paid as set forth in the Fee Subtitle, Seattle Municipal Code Title 22, Subtitle IX.

SECTION C108
ENFORCEMENT

C108.1 Authority. The *code official* is authorized to enforce this code in accordance with the International Building Code, International Mechanical Code and Seattle Electrical Code.

SECTION C109
ADMINISTRATIVE REVIEW

C109.1 Administrative review by the *code official*. Prior to issuance of the building permit, applicants may request administrative review by the *code official* of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the *code official*.

C109.2 Administrative review by the Construction Codes Advisory Board. After administrative review and review by the *code official*, and prior to issuance of the building permit, applicants may request review by the Construction Codes Advisory Board of decisions or actions pertaining to the application and interpretation of this code. The review will be performed by a panel of three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the *code official*.

SECTION C110
VIOLATIONS

It shall be unlawful for any person, firm, or corporation to erect or construct any building, or remodel or rehabilitate any existing building or structure in the state, or allow the same to be done, contrary to or in violation of any of the provisions of this code. Violations shall be administered according to the procedures set forth in Section 103 of the International Building Code.

SECTION C111
LIABILITY

Nothing contained in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of any city or county or its officers, employees or agents for any injury or damage resulting from the failure of a building to conform to the provisions of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

CHAPTER 2 [CE]
DEFINITIONS

SECTION C201
GENERAL

C201.1 Scope. Unless stated otherwise, the following words and terms in this code shall have the meanings indicated in this chapter.

C201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural includes the singular.

C201.3 Terms defined in other codes. Terms that are not defined in this code but are defined in the *International Building Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *Uniform Plumbing Code* or the *International Residential Code* shall have the meanings ascribed to them in those codes.

C201.4 Terms not defined. Terms not defined by this chapter shall have ordinarily accepted meanings such as the context implies.

ABOVE-GRADE WALL. That portion of a wall in the building thermal envelope that is not a below-grade wall. This includes between-floor spandrels, peripheral edges of floors, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

ACCESS (TO). That which enables a device, appliance or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel or similar obstruction.

ADDITION. An extension or increase in the *conditioned space* floor area, number of stories, or height of a building or structure.

AFFORDABLE HOUSING. Affordable housing for the purposes of this code shall include buildings which; a) receive or have received public funding or an allocation of federal low-income housing tax credits; and b) are subject to a regulatory agreement, covenant, or other legal instrument recorded on the property title, and enforceable by the City of Seattle, Washington State Housing Finance Commission, State of Washington, King County, U.S. Department of Housing and Urban Development, or other similar entity as *approved* by the Seattle Director of Housing, that either:

1) Restricts at least 40 percent of the units to occupancy by households earning no greater than 60 percent of median income, and controls the rents that may be charged, for a minimum period of 40 years; or
2) Restricts initial and subsequent sales of at least 40 percent of the residential units to households with incomes no greater than 80 percent of median income, for a minimum period of 50 years. The sale price for sales subsequent to the initial sale shall be calculated to allow modest growth in homeowner equity while maintaining long-term affordability for future buyers.

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.

AIR CURTAIN. A device, installed at the building entrance, that generates and discharges a laminar air stream intended to prevent the infiltration of external, unconditioned air into the conditioned spaces, or the loss of interior, conditioned air to the outside.

ALTERNATING CURRENT-OUTPUT UNINTERRUPTIBLE POWER SUPPLY (AC-OUTPUT UPS). A combination of convertors, switches and energy storage devices, such as batteries, constituting a power system for maintaining continuity of load power in case of input power failure. Input power failure occurs when voltage and frequency are outside rated steady state and transient tolerance bands or when distortion or interruptions are outside the limits specified for the uninterruptible power supply. An *AC-output UPC* is an uninterruptible power supply that supplies power with a continuous flow of electric charge that periodically reverses direction.

ALTERATION. Any construction, retrofit or renovation to an existing structure other than repair or addition. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

APPROVED. Acceptable to the *code official*.

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, or furnishing product certification research reports, when such agency has been *approved* by the *code official*.

ATTIC AND OTHER ROOFS. Roofs other than roofs with insulation entirely above deck and metal building roofs, including roofs with insulation entirely below (inside of) the roof structure (i.e., attics, cathedral ceilings, and single-rafter ceilings), roofs with insulation both above and below the roof structure, and roofs without insulation.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature or mechanical configuration (see "Manual").

AUTOMATIC CONTROL DEVICE. A device capable of automatically controlling equipment and devices without manual intervention.

BELOW-GRADE WALL. That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.

BEST EFFICIENCY POINT (BEP). The pump hydraulic power operating point (consisting of both flow and head conditions) that results in the maximum efficiency.

BIOGAS. A mixture of hydrocarbons that is a gas at 60°F (15.5°C) and one atmosphere of pressure that is produced through the anaerobic digestion of organic matter.

BIOMASS. Nonfossilized and biodegradable organic material originating from plants, animals and/or micro-organisms, including products, byproducts, residues and waste from agriculture, forestry and related industries as well as the nonfossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of nonfossilized and biodegradable organic material.

BLOCK. A generic concept used in energy simulation. It can include one or more thermal zones. It represents a whole building or portion of a building with the same use type served by the same HVAC system type.

BOILER, MODULATING. A boiler that is capable of more than a single firing rate in response to a varying temperature or heating load.

BOILER SYSTEM. One or more boilers, their piping and controls that work together to supply steam or hot water to heat output devices remote from the boiler.

BUBBLE POINT. The refrigerant liquid saturation temperature at a specified pressure.

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy, including any mechanical systems, service water heating systems and electric power and lighting systems located on the building site and supporting the building.

BUILDING COMMISSIONING. A process that verifies and documents that the building systems have been installed and function according to the approved construction documents.

BUILDING ENTRANCE. Any doorway, set of doors, revolving door, vestibule or other form of portal (including elevator doors such as in parking garages) that is ordinarily used to gain access to the building or to exit from the building by its users and occupants. This does not include doors solely used to directly enter mechanical, electrical and other building utility service equipment rooms, or doors for emergency egress only. Where buildings have separate one-way doors to enter or leave, any doors ordinarily used to leave the building are also deemed a building entrance.

BUILDING SITE. A contiguous area of land that is under the ownership or control of one entity.

BUILDING THERMAL ENVELOPE. The *below-grade walls*, *above-grade walls*, floors, ceilings, roofs, and any other building element assemblies that meet one or more of the following criteria:

1. Separates conditioned areas of all types from unconditioned or unenclosed areas.
2. Separates conditioned areas of differing types including elements between fully conditioned areas, low energy, semi-heated, greenhouse, and refrigerated areas.

C-FACTOR (THERMAL CONDUCTANCE). The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h $ft^2 \times °F$) [$W/(m^2 \times K)$].

CAPTIVE KEY DEVICE. A lighting control that will not release the key that activates the override when the lighting is on.

CAVITY INSULATION. Insulating material located between framing members.

CEILING FAN. A nonportable device suspended from a ceiling or overhead structure for circulating air via the rotation of the blades. See also **LARGE-DIAMETER CEILING FAN**.

CERTIFIED COMMISSIONING PROFESSIONAL. An individual who is certified by an ANSI/ISO/IEC 17024:2012 accredited organization to lead, plan, coordinate and manage commissioning teams and implement the commissioning process.

CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.
2. A change from one group to another group within an occupancy classification.
3. Any change in use within a group for which there is a change in the application of the requirements of this code.

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to the fixture supply and back to the water-heating equipment.

CLEAN WATER PUMP. A device that is designed for use in pumping water with a maximum nonabsorbent free solid content of 0.016 lb/ft^3 (0.256 kg/m^3) and with a maximum dissolved solid content of 3.1 lb/ft^3 (49.66 kg/m^3), provided that the total gas content of the water does not exceed the saturation volume, and disregarding any additives necessary to prevent the water from freezing at a minimum of 14°F (-10°C).

CLERESTORY FENESTRATION. See "**FENESTRATION**."

CLIMATE ZONE. A geographical region based on climatic criteria as specified in this code.

CODE OFFICIAL. The ((~~officer or other designated authority~~)) Director of the Seattle Department of Construction and Inspections charged with the administration and enforcement of this code, or a duly authorized representative.

COEFFICIENT OF PERFORMANCE (COP) - COOLING. The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP) - HEATING. The ratio of the rate of heat removal to the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system, including the compressor and, if applicable, auxiliary heat, under designated operating conditions.

COMMERCIAL BUILDING. For this code, all buildings that are not included in the definition of "Residential buildings."

COMMUNITY RENEWABLE ENERGY SYSTEM. An off-site renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.

COMPRESSED AIR SYSTEM. A system of at least one compressor providing compressed air at 40 psig or higher.

COMPUTER ROOM. A room whose primary function is to house equipment for the processing and storage of electronic data and that has a design total *information technology equipment (ITE)* equipment power density less than or equal to 20 watts per square foot (215 watts per m^2) of conditioned floor area or a design *ITE* equipment load less than or equal to 10 kW. See also **DATA CENTER**.

CONDENSING UNIT. A factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. The unit consists of one or more refrigerant compressors, refrigerant condensers (air-cooled, evaporatively cooled, or water-cooled), condenser fans and motors (where used) and factory-supplied accessories.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the *conditioned space*.

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling. Elevator shafts, stair enclosures, enclosed corridors connecting *conditioned spaces*, and *enclosed spaces* through which conditioned air is intentionally transferred at a rate exceeding three air changes per hour are considered *conditioned spaces* for the purposes of the *building thermal envelope* requirements.

CONTINUOUS INSULATION (CI). Insulating material that is continuous across all structural members without metal thermal bridges other than fasteners that have a total cross-sectional area not greater than 0.04 percent (0.12 percent where all metal thermal bridges are stainless steel) of the envelope surface through which they penetrate, and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

CONTROLLED PLANT GROWTH ENVIRONMENT. Group F and U buildings or spaces that are used exclusively for and specifically controlled to facilitate and enhance plant growth and production by manipulating various indoor environmental conditions. Technologies include indoor agriculture, cannabis growing, hydroponics, aquaculture and aquaponics. Controlled indoor environment variables include, but are not limited to, temperature, air quality, humidity, and carbon dioxide.

CONTROLLED RECEPTACLE. An electrical receptacle that is controlled by an *automatic control device*.

CURTAIN WALL. Fenestration products used to create an external nonload-bearing wall that is designed to separate the exterior and interior environments.

DATA ACQUISITION SYSTEM. An electronic system managed by the building owner to collect, tabulate and display metering information.

DATA CENTER. A room or series of rooms that share *data center systems* whose primary function is to house equipment for the processing and storage of electronic data, which has a design total *information technology equipment (ITE)* power density exceeding 20 watts per square foot (215 watts per m^2) of conditioned area and a total design *ITE* equipment load greater than 10 kW.

DATA CENTER SYSTEMS. HVAC systems, electrical systems, equipment, or portions thereof used to condition *ITE* or electrical systems in a *data center*.

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

DAYLIGHT ZONE. The portion of the building interior floor area that is illuminated by natural daylight through sidelit and toplit fenestration.

DECORATIVE APPLIANCE, VENTED. A vented appliance wherein the primary function lies in the aesthetic effect of the flames.

DEDICATED OUTDOOR AIR SYSTEM (DOAS). A ventilation system that supplies 100 percent outdoor air primarily for the purpose of ventilation without requiring operation of a space-conditioning system fan for outdoor air delivery.

DEMAND CONTROL KITCHEN VENTILATION (DCKV). A system that provides automatic, continuous control over exhaust hood, where required, and make-up air fan speed in response to one or more sensors that monitor cooking activity or through direct communication with cooking appliances.

DEMAND CONTROL VENTILATION (DCV). A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe.

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal*.

DESICCANT DEHUMIDIFICATION SYSTEM. A mechanical dehumidification technology that uses a solid or liquid material to remove moisture from the air.

DIRECT DIGITAL CONTROL (DDC). A type of control where controlled and monitored analog or binary data such as temperature and contact closures are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control physical devices.

DIRECTLY OWNED OFF-SITE RENEWABLE ENERGY SYSTEM. An off-site renewable energy system owned by the building project owner.

DISTRICT ENERGY EFFICIENCY FACTOR. Ratio of site energy input at the district plant required to produce a unit of heating or cooling at the project site on an annual basis, supported by calculations approved by the code official.

DOOR, GARAGE. Nonswinging doors rated by DASMA 105 with a single panel or horizontally hinged sectional panels.

DOOR, NONSWINGING. Roll-up, tilt-up, metal coiling and sliding doors, access hatches, and all other doors that are not swinging doors or garage doors with less than or equal to 14 percent glazing.

DOOR, SWINGING. Doors that are hinged on one side and revolving doors.

DUCT. A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

DX-DEDICATED OUTDOOR AIR SYSTEM UNITS (DX-DOAS UNITS). A type of air-cooled, water-cooled or water source factory assembled product that dehumidifies 100 percent outdoor air to a low dew point and includes reheat that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designated supply air temperature. This conditioned outdoor air is then delivered directly or indirectly to the conditioned spaces. It may precondition outdoor air by containing an enthalpy wheel, sensible wheel, desiccant wheel, plate heat exchanger, heat pipes, or other heat or mass transfer apparatus.

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and is essential to, the cultivation, protection or maintenance of plants. Greenhouses are those that are erected for a period of 180 days or more.

GROUP R. Buildings or portions of buildings that contain any of the following occupancies as established in the *International Building Code*:

1. Group R-1.
2. Group R-2 where located more than three stories in height above grade plane.

HEAT TRAP. An arrangement of piping and fittings, such as elbows, or a commercially available heat trap that prevents thermosyphoning of hot water during standby periods.

HEAT TRAP, PIPE CONFIGURED. A pipe configured heat trap is either, as applicable:

1. A device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees; or
2. Piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot-water distribution system.

HEATED SLAB-ON-GRADE FLOOR. Slab-on-grade floor construction in which the heating elements, hydronic tubing, or hot air distribution system is in contact with, or placed within or under, the slab.

HEATED WATER CIRCULATION SYSTEM. A water distribution system having one or more recirculation pumps that pump water from a heated water source through a dedicated hot water circulation pipe or piping system.

HIGH-END TRIM. A lighting control setting which limits the maximum power to individual luminaires or groups of luminaires in a space.

HIGH SPEED DOOR. A nonswinging door used primarily to facilitate vehicular access or material transportation, with a minimum opening rate of 32 inches (813 mm) per second, a minimum closing rate of 24 inches (610 mm) per second and that includes an automatic-closing device.

HISTORIC BUILDINGS. ((~~Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law. Any building or structure that is one or more of the following:~~

1. ~~Listed, or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.~~
2. ~~Designated as historic under an applicable state or local law.~~
3. ~~Certified as a contributing resource within a National Register-listed, state-designated or locally designated historic district.~~)) See "**LANDMARK**."

HUMIDISTAT. A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.

HVAC TOTAL SYSTEM PERFORMANCE RATIO (HVAC TSPR). The ratio of the sum of a building's annual heating and cooling load in thousands of Btus to the sum of annual carbon emissions in pounds from energy consumption of the building HVAC systems. Carbon emissions shall be calculated by multiplying site energy consumption by the carbon emission factors from Table ((~~C407.1~~)) D201.

IEC DESIGN H MOTOR. An electric motor that meets all of the following:

1. It is an induction motor designed for use with three-phase power.
2. It contains a cage rotor.
3. It is capable of direct-on-line starting.
4. It has 4, 6 or 8 poles.
5. It is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz.

IEC DESIGN N MOTOR. An electric motor that meets all of the following:

1. It is an inductor motor designed for use with three-phase power.
2. It contains a cage rotor.
3. It is capable of direct-on-line starting.
4. It has 2, 4, 6 or 8 poles.
5. It is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz.

INFILTRATION. The uncontrolled inward air leakage into a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density or both.

INFORMATION TECHNOLOGY EQUIPMENT (ITE). Items including computers, data storage, servers, network, and communication equipment.

INSULATION ENTIRELY ABOVE DECK. A roof with all insulation:

1. Installed above (outside of) the roof structure; and
2. Continuous (i.e., uninterrupted by framing members).

INTEGRATED ENERGY EFFICIENCY RATIO (IEER). A single-number figure of merit expressing cooling part-load EER efficiency for unitary air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

INTEGRATED HVAC SYSTEM. An HVAC system designed to handle both sensible and latent heat removal. Integrated HVAC systems may include, but are not limited to, HVAC systems with a sensible heat ratio of 0.65 or less and the capability of providing cooling, dedicated outdoor air systems, single package air conditioners with at least one refrigerant circuit providing hot gas reheat, and stand-alone dehumidifiers modified to allow external heat rejection.

INTEGRATED PART LOAD VALUE (IPLV). A single number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air conditioning and heat pump equipment on the basis of weighted operation at various load capacities for equipment.

INTEGRATED SEASONAL COEFFICIENT OF PERFORMANCE (ISCOP). A seasonal efficiency number that is a combined value based on the formula listed in AHRI Standard 920 of the two COP values for the heating season of a DX-DOAS unit water or air source heat pump, expressed in W/W.

INTEGRATED SEASONAL MOISTURE REMOVAL EFFICIENCY (ISMRE). A seasonal efficiency number that is a combined value based on the formula listed in AHRI Standard 920 of the four dehumidification moisture removal efficiency (MRE) ratings required for DX-DOAS units, expressed in lb. of moisture/kWh.

INTERNAL CURTAIN SYSTEM. A system consisting of moveable panels of fabric or plastic film used to cover and uncover the space enclosed in a *greenhouse* on a daily basis.

ISOLATION DEVICES. Devices that isolate HVAC zones so they can be operated independently of one another. Isolation devices include separate systems, isolation dampers and controls providing shutoff at terminal boxes.

IT (INFORMATION TECHNOLOGY) ENERGY. Electrical energy consumed by UPS (uninterruptible power supply) units, servers, and associated electronic data storage and data processing equipment, but not by lighting or HVAC equipment.

LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, *approved agency* or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LANDMARK. A building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation or has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, has been listed or determined eligible to be listed in the National Register of Historic Places, or is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of the structure.

LARGE-DIAMETER CEILING FAN. A ceiling fan that is greater than seven feet (2134 mm) in diameter. These fans are sometimes referred to as High-Volume, Low-Speed (HVLS) fans.

LARGEST NET CAPACITY INCREMENT. The largest increase in capacity when switching between combinations of base compressors that is expected to occur under the *compressed air system* control scheme.

LINER SYSTEM (LS). A system that includes the following:

1. A continuous vapor barrier liner membrane that is installed below the purlins and that is uninterrupted by framing members.
2. An uncompressed, unfaced insulation resting on top of the liner membrane and located between the purlins.

For multilayer installations, the last rated *R*-value of insulation is for unfaced insulation draped over purlins and then compressed when the metal roof panels are attached.

LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *code official* and concerned with evaluation of products or services that maintains periodic inspection of production of *listed* equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

LOW-CARBON DISTRICT ENERGY EXCHANGE SYSTEM. Any system serving multiple buildings providing energy in the form of a circulated fluid that can accept or reject heat from individual buildings. Energy can be indirectly converted to meet building heating or cooling loads by serving as the heat source or sink for heat-pump systems. Examples include, but are not limited to, low temperature condenser water, ground source condenser water, or sewer heat recovery.

MECHANICAL LOAD COEFFICIENT (MLC). In a *data center*, the ratio of the cooling system's net use of energy to that of the *ITE*. The annual MLC is calculated using hourly weather data for the data center's location and equals the sum of all energy flowing into the cooling system to respond to that weather, minus any energy successfully recovered to avoid any new energy use, all divided by the energy flowing into the *ITE* during the same period.

MECHANICAL ROOM. A room or space in which mechanical equipment and appliances are located that has sufficient room for access and maintenance of the equipment or appliances with room energy doors closed.

METAL BUILDING ROOF. A roof that:

1. Is constructed with a metal, structural, weathering surface;
2. Has no ventilated cavity; and
3. Has the insulation entirely below deck (i.e., does not include composite concrete and metal deck construction nor a roof framing system that is separated from the superstructure by a wood substrate) and whose structure consists of one or more of the following configurations:
    a. Metal roofing in direct contact with the steel framing members;
    b. Metal roofing separated from the steel framing members by insulation;
    c. Insulated metal roofing panels installed as described in a or b.

METAL BUILDING WALL. ((~~A *wall* whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain *wall systems*).~~)) See "Wall, metal building."

METER. A device that measures the flow of energy.

MICROCELL. A wireless communication facility consisting of an antenna that is either: (a) Four (4) feet in height and with an area of not more than 580 square inches; or (b) if a tubular antenna, no more than four (4) inches in diameter and no more than six (6) feet in length; and the associated equipment cabinet that is six (6) feet or less in height and no more than 48 square feet in floor area.

MULTI-PASS HEAT PUMP WATER HEATER. A heat pump water heater control strategy requiring multiple passes of water through the heat pump to reach the final target storage water temperature.

NAMEPLATE HORSEPOWER. The nominal motor output power rating stamped on the motor nameplate.

NEMA DESIGN A MOTOR. A squirrel-cage motor that meets all of the following:

1. It is designed to withstand full-voltage starting and developing locked-rotor torque as shown in paragraph 12.38.1 of NEMA MG 1.
2. It has pull-up torque not less than the values shown in paragraph 12.40.1 of NEMA MG 1.
3. It has breakdown torque not less than the values shown in paragraph 12.39.1 of NEMA MG 1.
4. It has a locked-rotor current higher than the values shown in paragraph 12.35.1 of NEMA MG 1 for 60 Hz and paragraph 12.35.2 of NEMA MG 1 for 50 Hz.
5. It has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

NEMA DESIGN B MOTOR. A squirrel-cage motor that meets all of the following:

1. It is designed to withstand full-voltage starting.
2. It develops locked-rotor, breakdown and pull-up torques adequate for general application as specified in Sections 12.38, 12.39 and 12.40 of NEMA MG 1.
3. It draws locked-rotor current not to exceed the values shown in paragraph 12.35.1 of NEMA MG 1 for 60 Hz and paragraph 12.35.2 of NEMA MG 1 for 50 Hz.
4. It has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

NEMA DESIGN C MOTOR. A squirrel-cage motor that meets all of the following:

1. It is designed to withstand full-voltage starting and developing locked-rotor torque for high-torque applications up to the values shown in paragraph 12.38.2 of NEMA MG 1 (incorporated by reference; see Sec. 431.15).
2. It has pull-up torque not less than the values shown in paragraph 12.40.2 of NEMA MG 1.
3. It has breakdown torque not less than the values shown in paragraph 12.39.2 of NEMA MG 1.
4. It has a locked-rotor current not to exceed the values shown in paragraph 12.35.1 of NEMA MG 1 for 60 Hz and paragraph 12.35.2 of NEMA MG 1 for 50 Hz.
5. It has a slip at rated load of less than 5 percent.

NETWORKED GUEST ROOM CONTROL SYSTEM. A control system, with access from the front desk or other central location associated with a Group R-1 building, that is capable of identifying the rented and unrented status of each guest room according to a timed schedule, and is capable of controlling HVAC in each hotel and motel guest room separately.

NONSTANDARD PART LOAD VALUE (NPLV). A single-number part-load efficiency figure of merit calculated and referenced to conditions other than IPLV conditions, for units that are not designed to operate at ARI standard rating conditions.

OCCUPANT SENSOR CONTROL. An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

OCCUPIED-STANDBY MODE. Mode of operation when an HVAC zone is scheduled to be occupied and an occupant sensor indicates no occupants are within the zone.

ON-SITE RENEWABLE ENERGY. Energy from *renewable energy resources* harvested at the building site.

OPAQUE DOOR. A door that is not less than 50 percent opaque in surface area.

PERSONAL WIRELESS SERVICE FACILITY. A wireless communication facility (WCF), including a microcell, which is a facility for the transmission and/or reception of radio frequency signals and which may include antennas, equipment shelter or cabinet, transmission cables, a support structure to achieve the necessary elevation, and reception and/or transmission devices or antennas.

PHOTOSYNTHETIC PHOTON EFFICACY (PPE). Photosynthetic photon flux divided by input electric power in units of micromoles per second per watt, or micromoles per joule as defined by ANSI/ASABE S640.

POWERED ROOF/WALL VENTILATORS. A fan consisting of a centrifugal or axial impeller with an integral driver in a weather-resistant housing and with a base designed to fit, usually by means of a curb, over a wall or roof opening.

POWER-OVER-ETHERNET LIGHTING (POE). Lighting sources powered by DC current utilizing Ethernet cables.

PRIMARY STORAGE. Compressed air storage located upstream of the distribution system and any pressure flow regulators.

PROCESS APPLICATION. A manufacturing, industrial, or commercial procedure or activity where the primary purpose is other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.

PROPOSED DESIGN. A description of the proposed building used to estimate annual energy use ((~~and carbon emissions~~)) from energy consumption for determining compliance based on total building performance and *HVAC total performance ratio*.

PUBLIC LAVATORY FAUCET. A lavatory faucet that is not intended for private use as defined by the *Uniform Plumbing Code* and that is supplied with both potable cold and hot water.

PUMP ENERGY INDEX (PEI). The ratio of a pump's energy rating divided by the energy rating of a minimally compliant pump. For pumps with the constant load operating mode, the relevant PEI is PEI_{CL}. For pumps with the variable load operating mode, the relevant PEI is PEI_{VL}.

RADIANT HEATING SYSTEM. A heating system that transfers heat to objects and surfaces within a conditioned space, primarily by infrared radiation.

READY ACCESS (TO). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel or similar obstruction.

REFRIGERANT DEW POINT. The refrigerant vapor saturation temperature at a specified pressure.

REFRIGERATED WAREHOUSE COOLER. An enclosed storage space that has a total chilled storage area of 3,000 ft^2 or greater and is designed to maintain a temperature of greater than 32°F but less than 55°F.

REFRIGERATED WAREHOUSE FREEZER. An enclosed storage space that has a total chilled storage area of 3,000 ft^2 or greater and is designed to maintain a temperature at or below 32°F.

REFRIGERATION SYSTEM, LOW TEMPERATURE. Systems for maintaining food product in a frozen state in refrigeration applications.

REFRIGERATION SYSTEM, MEDIUM TEMPERATURE. Systems for maintaining food product above freezing in refrigeration applications.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

RENEWABLE ENERGY INVESTMENT FUND (REIF). A fund established by the local government or other entity to accept payment from building owners to construct or acquire qualifying renewable energy (along with the associated RECs) on their behalf.

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, *biogas*, *biomass* or extracted from hot fluid or steam heated within the earth.

RENEWABLE POWER PURCHASE AGREEMENT. A power purchase agreement for off-site renewable energy where the owner agrees to purchase renewable energy output and the associated renewable energy certificates at a fixed price schedule.

REPAIR. The reconstruction or renewal of any part of an existing building.

REPLACEMENT AIR. Outdoor air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: Make-up air, supply air, transfer air and infiltration. However, the ultimate source of all replacement air is outdoor air. When replacement air exceeds exhaust, the result is exfiltration.

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof Recover" and "Roof Replacement."

RESIDENTIAL BUILDING. ((~~For this code, includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2 and R-3 buildings three stories or less in height above grade plane.~~)) For this code, the following building types are residential buildings:

1. Detached one- and two-family dwellings.
2. Multiple single-family dwellings (townhouses).
3. Group R-3 occupancy areas in buildings three stories or less in height above grade plane whose dwelling units are accessed directly from the exterior.
4. Group R-2 occupancy areas in buildings three stories or less in height above grade plane whose dwelling units are accessed directly from the exterior.
5. Accessory structures to residential buildings.

Group R-2 buildings with dwelling units accessed from interior corridors or other interior spaces are not residential buildings.

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment, roof deck, insulation, vapor retarder and interior finish. See also *attic and other roofs*, *metal building roof*, roof with *insulation entirely above deck* and *single-rafter roof*.

ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing *roof covering* without removing the existing *roof covering*.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new *roof covering*.

ROOFTOP MONITOR. A raised section of a roof containing vertical fenestration along one or more sides.

***R*-VALUE (THERMAL RESISTANCE).** The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \cdot ft^2 \cdot °F/Btu$) [$(m^2 \cdot K)/W$].

SATURATED-CONDENSING TEMPERATURE. The saturation temperature corresponding to the measured refrigerant pressure at the condenser inlet for single component and azeotropic refrigerants, and the arithmetic average of the dew point and *bubble point* temperatures corresponding to the refrigerant pressure at the condenser entrance for zeotropic refrigerants.

SDCI. The Seattle Department of Construction and Inspections.

SEMI-HEATED SPACE. An *enclosed space* within a building, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors), which:

1. Is heated but not cooled, and has an installed heating system output capacity greater than or equal to 3.4 Btu/(h-ft^2) but not greater than 8 Btu/(h-ft^2). Heating is permitted to be provided by heat pumps complying with the exception to Section C402.1.1.2; and
2. Is not a *walk-in cooler*, *walk-in freezer*, *refrigerated warehouse cooler* or *refrigerated warehouse freezer space*.

SENSIBLE RECOVERY EFFECTIVENESS. Change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and return air dry-bulb temperatures, expressed as a percentage, governed by AHRI Standard 1060.

SERVICE WATER HEATING. Heating water for domestic or commercial purposes other than space heating and process requirements.

SIDELIT. See Section C405.2.5.2.

SINGLE-PASS HEAT PUMP WATER HEATER. A heat pump water heater control strategy using variable flow or variable capacity to deliver water from the heat pump at the final target storage water temperature in a single-pass through the heat exchanger with variable incoming water temperatures.

SINGLE-RAFTER ROOF. A roof where the roof above and the ceiling below are both attached to the same wood rafter and where insulation is located in the space between these wood rafters.

SKYLIGHT. See "Fenestration."

SLAB BELOW GRADE. Any portion of a slab floor in contact with the ground which is more than 24 inches below the final elevation of the nearest exterior grade.

SLAB-ON-GRADE FLOOR. That portion of a slab floor of the building envelope that is in contact with the ground and that is either above grade or is less than or equal to 24 inches below the final elevation of the nearest exterior grade.

SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not *sleeping units*.

SMALL ELECTRIC MOTOR. A general purpose, alternating current, single speed induction motor.

SMALL BUSINESS. Any business entity (including a sole proprietorship, corporation, partnership or other legal entity) which is owned and operated independently from all other businesses, which has the purpose of making a profit, and which has fifty or fewer employees.

SOLAR HEAT GAIN COEFFICIENT (SHGC). The ratio of the solar heat gain entering the space through the fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation which is then reradiated, conducted or convected into the space.

SOLAR ZONE. A clear area or areas reserved solely for current and future installation of photovoltaic or solar hot water systems.

SPACE CONDITIONING CATEGORY. Categories are based on the allowed peak space conditioning output capacity per square foot of conditioned floor area, or the design set point temperature, for a building or space. Space conditioning categories include: Low energy, semi-heated, conditioned, refrigerated walk-in and warehouse coolers, and refrigerated walk-in and warehouse freezers.

STAND-ALONE DEHUMIDIFIER. A product with the sole purpose of dehumidifying the space that does not include a portable air conditioner, room air conditioner, or packaged terminal air conditioner. Stand-alone dehumidifier is a self-contained, electrically operated, and mechanically encased assembly consisting of:

1. A refrigerated surface (evaporator) that condenses moisture from the atmosphere;
2. A refrigerating system, including an electric motor;
3. An air-circulating fan; and
4. A means for collecting or disposing of the condensate.

STANDARD REFERENCE DESIGN. A version of the *proposed design* that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement ((~~and carbon emissions~~)) from energy consumption for compliance based on total building performance and *HVAC total system performance ratio*.

STEEL-FRAMED WALL. ((~~A *wall* with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud *walls* and curtain *wall systems*).~~)) See "Wall, steel framed."

STOREFRONT. A system of doors and windows mulled as a composite fenestration structure that has been designed to resist heavy use. *Storefront* systems include, but are not limited to, exterior fenestration systems that span from the floor level or above to the ceiling of the same story on commercial buildings, with or without mulled windows and doors.

SUBSYSTEM METER. A meter placed downstream of the energy supply meter that measures the energy delivered to a load or a group of loads.

SYSTEM. A combination of equipment and auxiliary devices (e.g., controls, accessories, interconnecting means and terminal elements) by which energy is transformed so it performs a specific function, such as HVAC, *service water heating* or lighting.

TEMPERATURE MAINTENANCE. The system used to maintain the temperature of the building service hot water delivery system, typically by circulation and reheating or by a heat trace system.

TEMPORARY GROWING STRUCTURE. A temporary growing structure has sides and roof covered with polyethylene, polyvinyl or similar flexible synthetic material and is used to provide plants with either frost protection or increased heat retention. Temporary structures are those that are erected for a period of less than 180 days.

TESTING UNIT ENCLOSURE AREA. The area sum of all the boundary surfaces that define the dwelling unit, sleeping unit, or occupiable conditioned space including top/ceiling, bottom/floor and all side walls. This does not include interior

partition walls within the dwelling unit, sleeping unit, or occupiable conditioned space. Wall height shall be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above.

THERMAL DISTRIBUTION EFFICIENCY (TDE). The resistance to changes in air heat as air is conveyed through a distance of air duct. TDE is a heat loss calculation evaluating the difference in the heat of the air between the air duct inlet and outlet caused by differences in temperatures between the air in the duct and the duct material. TDE is expressed as a percent difference between the inlet and outlet heat in the duct.

THERMOSTAT. An automatic control device used to maintain temperature at a fixed or adjustable set point.

TIME SWITCH CONTROL. An automatic control device or system that controls lighting or other loads, including switching off, based on time schedules.

TOPLIT. See Section C405.2.5.3.

TUBULAR DAYLIGHTING DEVICE (TDD). A nonoperable skylight device primarily designed to transmit daylight from a roof surface to an interior ceiling surface via a tubular conduit. The device consists of an exterior glazed weathering surface, a light transmitting tube with a reflective inside surface and an interior sealing device, such as a translucent ceiling panel.

***U*-FACTOR (THERMAL TRANSMITTANCE).** The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h • ft^2 • °F) [W/(m^2 • K)].

UNCONDITIONED SPACE. An *enclosed space* within a building that is not a *conditioned space* and that is not categorized under Section C402.1.1. Crawlspaces, attics and parking garages with natural or mechanical *ventilation* are not considered *enclosed spaces*.

UNHEATED SLAB-ON-GRADE FLOOR. A slab-on-grade floor that is not a heated slab-on-grade floor.

UNIFORM ILLUMINATION. A quality of illumination delivered by a lighting system typically comprised of similar fixtures mounted at a regular spacing interval. This lighting system provides a uniform contrast ratio of no greater than 5:1 maximum-to-minimum ratio throughout the entire area served, including task areas.

VARIABLE REFRIGERANT FLOW SYSTEM. An engineered direct-expansion (DX) refrigerant system that incorporates a common condensing unit, at least one variable capacity compressor, a distributed refrigerant piping network to multiple indoor fan heating and cooling units each capable of individual zone temperature control, through integral zone temperature control devices and a common communications network. Variable refrigerant flow utilizes three or more steps of control on common interconnecting piping.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTILATION AIR. That portion of supply air that comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

VERTICAL FENESTRATION. See "**FENESTRATION**."

VISIBLE TRANSMITTANCE [VT]. The ratio of visible light entering the space through the fenestration product assembly to the incident visible light, visible transmittance, includes the effects of glazing material and frame and is expressed as a number between 0 and 1. For skylights, VT shall be measured and rated in accordance with NFRC 202.

VISIBLE TRANSMITTANCE – ANNUAL [VT-ANNUAL]. The ratio of visible light entering the space through the fenestration product assembly to the incident visible light during the course of a year, which includes the effects of glazing material, frame, and light well or tubular conduit, and is expressed as a number between 0 and 1. For tubular daylighting devices, VT-annual shall be measured and rated in accordance with NFRC 203.

VOLTAGE DROP. A decrease in voltage caused by losses in the wiring system that connect the power source to the load.

WALK-IN COOLER. An enclosed storage space capable of being refrigerated to temperatures above 32°F (0°C) and less than 55°F (12.8°C) that can be walked into, has a ceiling height of not less than 7 feet (2134 mm) and has a total chilled storage area of less than 3,000 square feet (279 m^2).

WALK-IN FREEZER. An enclosed storage space capable of being refrigerated to temperatures at or below 32°F (0°C) that can be walked into, has a ceiling height of not less than 7 feet (2134 mm) and has a total chilled storage area of less than 3,000 square feet (279 m^2).

WALL. That portion of the *building envelope*, including opaque area and *fenestration*, that is vertical or tilted at an angle of 60 degrees from horizontal or greater. This includes *above-grade walls* and *below-grade walls*, between-floor spandrels, peripheral edges of floors, foundation *walls*, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and skylight shafts.

WALL, METAL BUILDING. A *wall* whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain *wall systems*).

WALL, STEEL-FRAMED. A *wall* with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud *walls* and curtain *wall systems*).

WALL, WOOD-FRAMED AND OTHER. All other *wall* types, including wood stud *walls*.

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

WOOD-FRAMED AND OTHER WALLS. ((~~All other wall types, including wood stud walls.~~)) See "Wall, wood-framed and other."

ZONE. A space or group of spaces within a building with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained throughout using a single controlling device.

CHAPTER 3 [CE]
GENERAL REQUIREMENTS

SECTION C301
CLIMATE ZONES

C301.1 General. *Climate zones* from Table C301.1 shall be used in determining the applicable requirements from Chapter 4. Seattle is in Zone 4-C (4-Marine).

TABLE C301.1
CLIMATE ZONES, MOISTURE REGIMES, AND
WARM-HUMID DESIGNATIONS BY STATE AND COUNTY

Key: A – Moist, B – Dry, C – Marine Absence of moisture designation indicates moisture regime is irrelevant		
WASHINGTON		
5B Adams	4C Grays Harbor	4C Pierce
5B Asotin	4C Island	4C San Juan
5B Benton	4C Jefferson	4C Skagit
5B Chelan	4C King	5B Skamania
4C Clallam	4C Kitsap	4C Snohomish
4C Clark	5B Kittitas	5B Spokane
5B Columbia	5B Klickitat	5B Stevens
4C Cowlitz	4C Lewis	4C Thurston
5B Douglas	5B Lincoln	4C Wahkiakum
5B Ferry	4C Mason	5B Walla Walla
5B Franklin	5B Okanogan	4C Whatcom
5B Garfield	4C Pacific	5B Whitman
5B Grant	5B Pend Oreille	5B Yakima

SECTION C302
DESIGN CONDITIONS

C302.1 Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

C302.2 Exterior design conditions. The heating or cooling outdoor design temperatures shall be ((~~selected from Appendix C~~)) 24°F for heating and 86°F dry bulb and 67°F wet bulb for cooling.

SECTION C303
MATERIALS, SYSTEMS AND EQUIPMENT

C303.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

C303.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. For insulated siding, the *R*-value shall be labeled on the product's package and shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

Exception: For roof insulation installed above the deck, the *R*-value shall be labeled as required by the material standards specified in Table 1508.2 of the *International Building Code*.

C303.1.1.1 Blown or sprayed roof/ceiling insulation. The thickness of blown-in or sprayed fiberglass and cellulose roof/ceiling insulation shall be written in inches (mm) on markers for every 300 square feet (28 m^2) of attic area throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers of not less than 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

C303.1.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection. For insulation materials that are installed without an observable manufacturer's *R*-value mark, such as blown or draped products, an insulation certificate complying with Section C303.1.1 shall be left immediately after installation by the installer, in a conspicuous location within the building, to certify the installed *R*-value of the insulation material.

C303.1.3 Fenestration product rating. *U*-factors of fenestration shall be determined as follows:

1. For windows, doors and skylights, *U*-factor ratings shall be determined in accordance with NFRC 100.
2. Where required for garage doors and rolling doors, *U*-factor ratings shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer.

Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table C303.1.3(1), C303.1.3(2) or C303.1.3(4). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table C303.1.3(3). For tubular daylighting devices, VT_{annual} shall be measured and rated in accordance with NFRC 203.

Exception: Units without NFRC ratings produced by a small business may be assigned default *U*-factors from Table C303.1.3(5) for vertical fenestration.

TABLE C303.1.3(1)
DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT *U*-FACTORS

FRAME TYPE	Window and Glass Door		SKYLIGHT
	SINGLE PANE	DOUBLE PANE	
Metal	1.20	0.80	See Table C303.1.3(4)
Metal with Thermal Break[a]	1.10	0.65	
Nonmetal or Metal Clad	0.95	0.55	
Glazed Block	0.60		

[a] Metal Thermal Break = A metal thermal break framed window shall incorporate the following minimum design characteristics:
1) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/h/ft^2/°F;
2) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and
3) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in 1) and 2) above.

TABLE C303.1.3(2)
DEFAULT OPAQUE DOOR *U*-FACTORS
See Appendix A, Section A107

TABLE C303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC AND VT

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.40	0.40	0.40	0.40	0.40
VT	0.6	0.3	0.6	0.3	0.6

TABLE C303.1.3(4)
DEFAULT *U*-FACTORS FOR SKYLIGHTS

FENESTRATION TYPE	FRAME TYPE			
	ALUMINUM WITHOUT THERMAL BREAK	ALUMINUM WITH THERMAL BREAK	REINFORCED VINYL/ALUMINUM-CLAD WOOD OR VINYL	WOOD OR VINYL-CLAD WOOD/VINYL WITHOUT REINFORCING
Single Glazing				
glass	U-1.58	U-1.51	U-1.40	U-1.18
acrylic/polycarb	U-1.52	U-1.45	U-1.34	U-1.11
Double Glazing				
air	U-1.05	U-0.89	U-0.84	U-0.67
argon	U-1.02	U-0.86	U-0.80	U-0.64
Double Glazing, *e*=0.20				
air	U-0.96	U-0.80	U-0.75	U-0.59
argon	U-0.91	U-0.75	U-0.70	U-0.54
Double Glazing, *e*=0.10				
air	U-0.94	U-0.79	U-0.74	U-0.58
argon	U-0.89	U-0.73	U-0.68	U-0.52
Double Glazing, *e*=0.05				
air	U-0.93	U-0.78	U-0.73	U-0.56
argon	U-0.87	U-0.71	U-0.66	U-0.50
Triple Glazing				
air	U-0.90	U-0.70	U-0.67	U-0.51
argon	U-0.87	U-0.69	U-0.64	U-0.48
Triple Glazing, *e*=0.20				
air	U-0.86	U-0.68	U-0.63	U-0.47
argon	U-0.82	U-0.63	U-0.59	U-0.43
Triple Glazing, *e*=0.20 on 2 surfaces				
air	U-0.82	U-0.64	U-0.60	U-0.44
argon	U-0.79	U-0.60	U-0.56	U-0.40
Triple Glazing, *e*=0.10 on 2 surfaces				
air	U-0.81	U-0.62	U-0.58	U-0.42
argon	U-0.77	U-0.58	U-0.54	U-0.38
Quadruple Glazing, *e*=0.10 on 2 surfaces				
air	U-0.78	U-0.59	U-0.55	U-0.39
argon	U-0.74	U-0.56	U-0.52	U-0.36
krypton	U-0.70	U-0.52	U-0.48	U-0.32

Notes for Table C303.1.3(4)

1. U-factors are applicable to both glass and plastic, flat and domed units, all spacers and gaps.
2. Emissivities shall be less than or equal to the value specified.
3. Gap fill shall be assumed to be air unless there is a minimum of 90% argon or krypton.
4. Aluminum frame with thermal break is as defined in footnote 1 to Table C303.1.3(1).

TABLE C303.1.3(5)
SMALL BUSINESS COMPLIANCE TABLE
DEFAULT *U*-FACTORS FOR VERTICAL FENESTRATION

Vertical Fenestration Description				Frame Type		
Panes	Low-e[1]	Spacer	Fill	Any Frame	Aluminum Thermal Break[2]	Wood/Vinyl/ Fiberglass
Double[3]	A	Any	Argon	0.48	0.41	0.32
	B	Any	Argon	0.46	0.39	0.30
	C	Any	Argon	0.44	0.37	0.28
	C	High Performance	Argon	0.42	0.35	Deemed to comply[5]
Triple[4]	A	Any	Air	0.50	0.44	0.26
	B	Any	Air	0.45	0.39	0.22
	C	Any	Air	0.41	0.34	0.20
	Any double low-e	Any	Air	0.35	0.32	0.18

[1] Low-eA (emissivity) shall be 0.24 to 0.16.
Low-eB (emissivity) shall be 0.15 to 0.08.
Low-eC (emissivity) shall be 0.07 or less.

[2] Aluminum Thermal Break = An aluminum thermal break framed window shall incorporate the following minimum design characteristics:
a) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/h/ft^2/°F;
b) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and
c) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in a) and b) above.

[3] A minimum air space of 0.375 inches between panes of glass is required for double glazing.

[4] A minimum air space of 0.25 inches between panes of glass is required for triple glazing.

[5] Deemed to comply glazing shall not be used for performance compliance.

C303.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (C.F.R. Title 16, Part 460) in units of h × ft^2 × °F/Btu at a mean temperature of 75°F (24°C).

C303.1.4.1 Insulated siding. The thermal resistance (*R*-Value) shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.

C303.1.5 Spandrel panels in glass curtain walls. Table C303.1.5 provides default *U*-factors for the spandrel section of glass and other curtain wall systems. Design factors that affect performance are the type of framing, the type of spandrel panel and the *R*-value of insulation. Four framing conditions are considered in the table. The first is the common case where standard aluminum mullions are used. Standard mullions provide a thermal bridge through the insulation, reducing its effectiveness. The second case is for metal framing members that have a thermal break. A thermal break frame uses a urethane or other nonmetallic element to separate the metal exposed to outside conditions from the metal that is exposed to interior conditions. The third case is for structural glazing or systems where there are no exposed mullions on the exterior. The fourth case is for the condition where there is no framing or the insulation is continuous and uninterrupted by framing. The columns in the table can be used for any specified level of insulation between framing members installed in framed curtain walls or spandrel panels.

C303.1.5.1 Window wall application. Where "window wall" or similar assembly that is discontinuous at intermediate slab edges is used, the slab edge *U*-value shall be as listed in Appendix Table ((~~A103.3.7.1(3)~~)) A103.3.7.2 or as determined using an approved calculation.

C303.1.5.2 Table value assumptions. In addition to the spandrel panel assembly, the construction assembly *U*-factors assume an air gap between the spandrel panel (with an *R*-value of 1.39) and one layer of 5/8-inch gypsum board (with an *R*-value of 0.56) that provides the interior finish. The gypsum board is assumed to span between the window sill and a channel at the floor. For assemblies that differ from these assumptions, custom *U*-factors can be calculated to account for any amount of continuous insulation or for unusual construction assemblies using Equations 3-1, 3-2 or 3-3 where appropriate. Spandrel panel *U*-factors for assemblies other than those covered by Table C303.1.5 or Equations 3-1 through 3-3 may be determined using an alternate approved methodology. Equations 3-1 through 3-3 do not calculate the value of any insulation inboard of the curtain wall assembly.

Aluminum without Thermal Break
(Equation 3-1)

$$U_{overall} = \left[\frac{1}{(R_{gypsum} + R_{airgap}) + \left[\frac{1}{0.2798 + \left(\frac{0.8929}{R_{addedinsulation} + \left(\frac{1}{U_{centerofglass}}\right)}\right)}\right]}\right]$$

CHAPTER 4 [CE]
COMMERCIAL ENERGY EFFICIENCY

SECTION C401
GENERAL

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with the fossil fuel compliance path according to Section C401.3, or with one of the following:

1. Prescriptive ((~~compliance~~)) path. The prescriptive compliance option requires compliance with ((~~Sections C402 through C406, and Sections C408, C409, C410, C411, and C412~~)) all of Chapter 4, other than Sections C401.3, C401.5, and C407.
2. Total building performance path. The total building performance option requires compliance with Section C407.
3. Appendix F is not adopted by The City of Seattle. ((~~adopted by the local jurisdiction, the requirements of Appendix F, Outcome-Based Energy Budget, Sections C408, C409, C410, C411, C412 and any specific sections in Table C407.2 as determined by the local jurisdiction. The Proposed Total UA of the proposed building shall be no more than 20 percent higher than the Allowed Total UA as defined in Section C402.1.5.~~))
4. Target Performance Path. The requirements of Section C401.5.

C401.2.1 Application to existing buildings. Additions, alterations, repairs, and changes of space conditioning, occupancy, or use to existing buildings shall comply with Chapter 5.

C401.2.2 Application to process equipment. Energy using equipment used by a manufacturing, industrial, or commercial process other than for conditioning spaces or maintaining comfort and amenities for the occupants shall comply with Section C401.3 Item 2, C403.3.2, Tables C403.3.2(1) through (16) inclusive, Sections C403.3.4.1 through C403.3.4.3, C403.7.7, C403.9.2.1, C403.10.3, C403.11.2, C403.11.3, ((~~Table C404.2, and Sections~~)) C404.2, C404.6, C404.13, C405.8, C410, and C412.

C401.3 Fossil fuel compliance path. Buildings complying with the fossil fuel compliance path shall comply with the prescriptive compliance path of this code as defined in Item 1 of Section C401.2, and as modified by this Section C401.3.

C401.3.1 Modification of code requirements. For use of this compliance path only, the following changes shall be made to this code:

1. Section C403.1.4 – Space heating. Strike the phrase "...or fossil fuel combustion..." from the first sentence of Section C403.1.4.
2. Section C404.2.1 – Service water heating. Revise the first sentence of Section C404.2.1 to read: "Service hot water shall be provided by fossil fuel water heating equipment, electric air-source heat pump water heating equipment, electric resistance water heating equipment, or a combination of these equipment types meeting the requirements of this section."
3. ((~~Section C406.2.5 – Renewable energy. When determining renewable energy credits in Equation 4-17 of Section C406.2.5, strike the phrase "...limited to 50 percent of the required credits in Section C406.1" in the definition of the factor AEC_{RRa}~~)) Reserved.
4. Table C406.2(1) – Efficiency measure credits. Use Table C406.2(2) credit values in place of Table C406.2(1) credit values.

C401.3.2 Fossil fuel equipment. Fossil fuel combustion appliances are permitted for HVAC heating, and shall comply with the applicable efficiency standards referenced in Section C403.3.3.2. Fossil fuel combustion appliances are permitted for service water heating, and shall comply with applicable efficiency standards referenced in Table C404.2.

C401.3.3 Additional efficiency credits. The number of additional efficiency credits required by Table C406.1 shall be increased by the number required in Table C401.3.3, modified as permitted in this section, and is in addition to the energy efficiency credits and load management credits required by Section C406.

EXCEPTION: The required number of space heating additional efficiency credits are permitted to be reduced in the following instances:

1. Low energy spaces in accordance with Section C402.1.1.1 and equipment buildings in accordance with Section C402.1.2 that are served by space heating systems shall comply with sufficient measures from Table C406.2(1) or Table C406.2(2) to achieve a minimum of 50 percent of the efficiency credits required for new construction by Table C401.3.3, modified as permitted in this section.

2. Building additions that have less than 1,000 square feet of conditioned floor area and that comply with sufficient measures from Table C406.2(1) or Table C406.2(2) to achieve a minimum of 50 percent of the additional efficiency credits required for additions by Table C401.3.3, modified as permitted in this section.
3. Semi-heated spaces in accordance with Section C402.1.1.2 that comply with sufficient measures from Table C406.2(1) or Table C406.2(2) to achieve a minimum of 50 percent of the ((~~space heating~~)) additional efficiency credits required by Table C401.3.3, modified as permitted in this section.
4. Unconditioned spaces, open parking garages and ((~~unheated~~)) unconditioned enclosed parking garages are not required to achieve the additional efficiency credits for space heating required by Table C401.3.3.

TABLE C401.3.3
ADDITIONAL CREDITS REQUIRED

Measure Title	Applicable Section	R-1	R-2	B	E	M	All other
New building – Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	7	24	101	38	111	56
New building – Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C401.3.3.2	198	212	27	17	79	107
Building additions – Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	4	12	51	19	56	28
Building additions – Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C401.3.3.1	99	106	14	9	40	54

C401.3.3.1 HVAC credit modification. The number of HVAC heating energy efficiency credits required by Table C401.3.3 is permitted to be decreased according to the following equation:

((~~CR = A x (B - C)/D~~)) CR = A x (C - B)/D

Where:

CR = additional credits required, rounded to the nearest whole number
A = baseline HVAC heating credits from Table C401.3.3
B = installed fossil fuel or electric resistance space heating capacity in kBTU/h of space heating appliances that comply with any of the exceptions to Section C403.1.4
C = total installed fossil fuel or electric resistance space heating capacity in kBTU/h of all HVAC heating appliances
D = total capacity in kBTU/h of all types of space heating appliances

C401.3.3.2 Service water heating credit modification. The number of service water heating energy efficiency credits required by Table C401.3.3 is permitted to be decreased according to the following equation:

((~~CR = A x (B - C)/D~~)) CR = A x (C - B)/D

Where:

CR = additional credits required, rounded to the nearest whole number
A = baseline service water heating credits from Table C401.3.3
B = installed service water heating appliances capacity in kBTU/h of service water heating appliances that comply with ((~~any of the~~)) exceptions 1, 2, 5, 7, or 8 to Section C404.2.1
C = total installed fossil fuel or electric resistance service water heating capacity in kBTU/h of all service water heating appliances, except the supplemental capacity permitted by Section C404.2.1.4
D = total capacity in kBTU/h of all types of service water heating appliances, except the supplemental capacity permitted by Section C404.2.1.4

C401.3.4 Renewable energy credit limit. No more than 80 percent of the efficiency credits required by Sections C401.3.3.1 and C401.3.3.2 are permitted to be Renewable Energy credits defined in Section C406.2.5.

C401.3.5 Discrete area-weighted project compliance. In addition to the area-weighted credit requirements in Section C406.1.2, where a building includes multiple occupancies, the additional required credits per Table C401.3.3 shall be determined separately for each occupancy group. Additional required credits shall be prorated on an area-weighted basis for each occupancy group in the same manner as required project credits per Section C406.1.

1. Where a single space heating or service water heating system serves multiple occupancies, the number of additional required credits shall be prorated on an area-weighted basis for each occupancy served.
2. Additional required credits for envelope systems shall be prorated on an area-weighted basis for all occupancies.
3. Occupancies are permitted to be subdivided into discrete areas, with required and achieved credits for each area prorated on an area-weighted basis as required for the occupancy group.

C401.3.6 Electrification readiness. Additionally, the following provisions shall be required for new construction for each fossil fuel space heating or service water heating appliance installed:

1. Provide a spare electrical branch circuit conduit to the location of a future replacement heat pump appliance to support an equivalent heating capacity.
2. Provide spare electrical service entrance conduits for the purpose of upgrading the main electrical service to support all heat pump appliances throughout the building.
3. The main electrical room has sufficient space to accommodate increasing the main electrical service's size to support all heat pump appliances throughout the building.
4. Additional accommodations for the equipment comprised of transformer(s) and other equipment necessary to support an electrical service upgrade. These accommodations shall include adequate space on the site. If the equipment is located in a transformer vault, that vault must include not only the space to support electrical service upgrade but also include accommodations for additional cooling for larger transformer(s).

C401.4 Thermal envelope certificate. A permanent thermal envelope certificate shall be completed by an *approved* party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other *approved* location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include:

1. *R*-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, crawlspace walls and floors, and ducts outside *conditioned spaces*.
2. *U*-factors and *solar heat gain coefficients* (SHGC) of fenestration.
3. Results from any building envelope air leakage testing performed on the building.

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10 percent or more of the total component area.

C401.5 Target Performance Path.

C401.5.1 Scope. Buildings of the following occupancy types, including their initial tenant improvements, are permitted to conform to the Target Performance Path as described in this section and are not required to comply with Seattle Energy Code requirements other than the mandatory measures listed in Section C401.5.3.

1. Group B office.
2. Group B medical office.
3. Group R-2 multi-family over three stories.
4. Group S-1 & S-2 warehouse (non-refrigerated).
5. Group E school.
6. Group M retail.
7. Group I-2 hospital.
8. Other occupancy type, where specific permission is granted by the *code official*. Any such permission, if granted, shall be made on the basis of an energy use target *approved* by the *code official* for that occupancy based on the best-performing local examples of that occupancy, adjusted to recognize the additional stringency of the current energy code.
9. Mixed use: A mixed use building is any building containing more than one of the occupancies listed in 1 through 8 above.

C401.5.1.1 Increased building performance factor. Each building conforming to this section is permitted to utilize a building performance factor (BPF) 1.12 times the BPF in Table C407.3(2).

C401.5.1.2 Site Energy Performance Target. Each building conforming to this section must demonstrate compliance with the Site energy performance factor per Table C407.3(3) as part of the permit review. Documentation of compliance with Site Energy Performance Target during the performance period is not required.

C401.5.2.1 Data Center Energy. Anticipated total *data center* energy use is permitted to be added to the overall building energy usage target in accordance with this section. The anticipated *IT energy* usage shall be multiplied by a factor of 1.45 to determine the anticipated total *data center* energy use. The *IT energy* usage shall be separately sub-metered in a secure manner *approved* by the *code official* and automatically exported to the *code official* showing daily, monthly and annual totals during the operational energy use demonstration period set forth in Section C401.5.6. Actual *IT energy* shall be adjusted in accordance with Section C401.5.7.

C401.5.3 Mandatory measures. Buildings using the Target Performance Path shall:

1. Not exceed the building performance factor (BPF) permitted by Section C401.5.1.1;
2. Not use fossil fuel combustion or electric resistance appliances for purposes of space heating or domestic water heating, except as permitted by the exceptions to Section C403.1.4;
3. Have a building envelope with a Proposed Total UA no greater than the Allowable Total UA as determined by Section C407.3.1; and
4. Comply with the mandatory measures listed in Table C407.2.

C401.5.4 Energy modeling methodology. Energy use shall be modeled according to the requirements of Section C407, Total Building Performance:

Schedules, internal loads and other assumptions related to the operation of the building are permitted to be developed at the discretion of the design team and the energy modeler. For occupancy types listed in Appendix B of this code, where any of the following operating loads or schedules of operating hours used in modeling calculations is less than 80 percent of that listed in Appendix B, or where the occupant density in square feet per occupant is more than 120 percent of that listed in Appendix B, such deviations shall be clearly documented in the final analysis report and are subject to approval by the *code official*.

1. Occupant density and schedule.
2. Lighting operation schedule.
3. Receptacle loads and schedule.
4. Elevator and escalator schedule.
5. Water heating quantity and schedule.

In addition to documenting modeling assumptions, the application documentation required by Section G1.3.2 of ASHRAE 90.1, Appendix G, shall include the following:

1. Summary of principal building characteristics that are above or below prescriptive energy code requirements.
2. Sensitivity analysis of principal internal load and other building operational assumptions that demonstrate a range of expected energy performance in the context of typical meteorological year (TMY) conditions. The following sensitivity analyses shall be reported, in tabular format:
    2.1. Occupant density +/- 20 percent (except residential occupancies).
    2.2. Lighting Power Density +/- 20 percent.
    2.3. Miscellaneous Load Power Density +/- 20 percent.
    2.4. Infiltration Rates +/- 20 percent.
    2.5. Temperature Setpoints +/- 2 degrees F.

Table C401.5.4
Example of Sensitivity Analysis Report Format

Allowable EUI: 45 kBTU/ft^2		
Predicted EUI: 40 kBTU/ft^2		
Input	EUI (Low Range)	EUI (High Range)
Occupant Density	35	42
Lighting Power Density	38	41
Misc. Load Power Density	35	45
Infiltration	38	44
Temperature Setpoints	36	48

C401.5.5 Energy modeler qualifications. Energy models shall be created only by persons qualified by education and training to perform such work and who have at least two years' experience modeling buildings of similar scale and complexity. The modeling documentation submitted shall be signed either by a licensed professional engineer who is qual-

ified by training and experience to perform energy modeling or by an individual with an active certification from ASHRAE as a Building Energy Modeling Professional (BEMP).

C401.5.6 Demonstration of operating energy use. Metered energy data shall be supplied directly via automated reporting from utilities to the *code official* using Portfolio Manager, and adjusted for the percentage of the *conditioned floor area* intended for occupancy that is occupied during the recording period. While more than 95 percent occupied, the building shall be considered fully occupied. While no less than 85 percent occupied, the building shall operate at or below its assigned building performance factor established in Section C401.5.2 or Item 8 of Section C401.5.1 for any recording period of 12 consecutive months that is completed within three years of the date of the Certificate of Occupancy, as adjusted under this Section C401.5. The owner shall notify the *code official* when this 12-month period has been successfully completed.

SDCI Informative Note: Documentation of compliance with the site energy reduction target in Section C407.3 is not required.

C401.5.6.1 Extension of demonstration period. For good cause, including conditions where less than 75 percent of the building is occupied, the *code official* may extend the three-year period for one additional year, but in no case for more than three additional one-year periods. If the building is not at least 75 percent occupied after three additional one-year periods, the *code official* shall evaluate compliance with Section C401.5.6 based on the most recent one-year period and adjusted for the actual occupancy rate during that period.

C401.5.7 Adjustment for data center energy usage. Where *data center IT energy* usage during the demonstration period, multiplied by a factor of 1.45, is higher than the total *data center* energy use as calculated according to Section C401.5.2.1, that additional energy shall be added to the total allowable energy use. Where *data center IT energy* use, multiplied by a factor of 1.45, is lower than the total *data center* energy use as calculated according to Section C401.5.2.1, that shortfall shall be subtracted from the total allowable energy use.

C401.5.8 Adjustment for change in occupancy. When the occupancy of the building or a portion of the building changes from that assumed in the permit submittal, the assigned energy performance target shall be adjusted to reflect the new occupancy. If the new occupancy is not listed in Section C401.5.2, either the *code official* shall assign it an energy use target based on the best-performing local examples of that occupancy type, or a metering system shall be provided that excludes the energy loads for the additional occupancy.

C401.5.9 Adjustment for unusually cold years. If the heating degree days (HDD) recorded by the National Weather Service for the Seattle-Tacoma International Airport exceeds 4,885 HDD for the 12-month demonstration period (4 percent above the average 4,697 HDD at 65°F base), the assigned energy performance target is permitted to be increased by 1 percent for that period.

C401.5.10 Adjustment for retail operating hours. If the annual number of hours that a retail occupancy is open to the public during the 12-month recording period exceeds the hours assumed in the energy model by more than 4 percent, the annual energy use target for the retail space use only is permitted to be increased by 1 percent for each 4 percent increase in such hours. This claim shall be documented by publicly available published hours of operation.

C401.5.11 Adjustment for commercial kitchens and other large process loads. Where the building includes a commercial kitchen, commercial laundry, hospital central sterile processing facility, or similar large process load, and where *approved* by the *code official*, the energy use of the process equipment and exhaust fans and relief air fans and air tempering associated with the use of that equipment is permitted to be separately sub-metered and subtracted from the overall building energy usage. Energy use of typical HVAC, lighting, and miscellaneous electrical loads within such spaces shall not be included in this adjustment. An *approved* plan shall be submitted with the permit documents detailing how the sub-metered process load energy will be automatically deducted from the total building energy use and the adjusted total reported to the *code official*.

C401.5.12 Financial security. The applicant shall provide a financial security to be used as a penalty for failing to achieve an operating energy use lower than the building's energy use target according to Section C401.5.6. The penalty shall be administered as provided in Section C110, except that the amount of the penalty shall be determined using Table C401.5.13 and not Section C107. The financial security shall be submitted to and *approved* by the *code official* prior to issuance of the building's Certificate of Occupancy. The financial security requirement shall be fulfilled by one of the following methods:

1. An irrevocable letter of credit from a financial institution authorized to do business in Seattle, in an amount equal to $4.00 per square foot of gross *conditioned floor area*.
2. A bond secured by the applicant to ensure compliance with this section, in an amount equal to $4.00 per square foot of gross *conditioned floor area*.
3. A binding pledge that within 3 years of receipt of the Certificate of Occupancy, adjusted as allowed under Section C401.5.6.1, the applicant will comply with the requirements of this section.

3.1. A binding pledge pursuant to item 3 of this subsection shall be recorded as a covenant in the land records of King County between the applicant and The City of Seattle in a form that is satisfactory to the Seattle City Attorney. The covenant shall bind the applicant and any successors in title to pay any fines levied pursuant to this section. A lien will be placed on the property in cases of non-payment.

If the owner provides evidence that the building has operated at or below its target energy performance level as provided in Section C401.5.6, the financial security provided by the applicant shall be returned to the applicant, or the pledge and covenant shall be released, and the applicant will have no further obligations under this section.

C401.5.13 Procedure for non-compliance. If the owner fails to provide evidence that the building has operated as required under Section C401.5.6, the *code official* shall, as applicable, either:

1. Draw down on a financial security provided in the form of an irrevocable letter of credit or a bond, in whole, or in part; or
2. Levy a fine against an applicant that provided a financial security in the form of a binding pledge as set forth in Section C401.5.12(3). The fine shall be issued as a civil penalty.

The amount of the fine levied or the amount drawn down from a financial security shall be determined according to Table C401.5.13.

Table C401.5.13
Financial Security and Energy Efficiency Reimbursements

Energy use exceeding target	Amount of fine or draw-down from financial security, per square foot of gross conditioned floor area	Maximum reimbursement per square foot of gross conditioned floor area for work *approved* under Section C401.5.12
Less than 10%	$1.00	$0.50
10% to less than 20%	$2.00	$1.00
20% to less than 30%	$3.00	$1.50
30% or greater	$4.00	$2.00

C401.5.14 Reimbursements. Where a financial security has been drawn down pursuant to item 1 in Section C401.5.13, or a fine has been levied pursuant to item 2 in Section C401.5.13, the *code official* shall reimburse the owner for documented expenses incurred to lower the operating energy use of the building, including commissioning, repairs or improvements to the existing energy-consuming systems, or provision of additional energy efficiency measures, up to the maximum reimbursement amounts listed in Table C401.5.13. Such expenditures shall be *approved* in advance by the *code official*, and the work shall be fully completed within one year of the date when a financial security has been drawn down pursuant to item 1 in Section C401.5.13, or a fine has been levied pursuant to item 2 in Section C401.5.13.

SECTION C402
BUILDING ENVELOPE REQUIREMENTS

C402.1 General. *Building thermal envelope* assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in Item 1 of Section C401.2, shall comply with the following:

1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the R-value based method of Section C402.1.3, the U-, C- and F-factor based method of Section C402.1.4, or the component performance alternative of Section C402.1.5.
2. Fenestration in the building envelope assemblies shall comply with Section C402.4, or the component performance alternative of Section C402.1.5.
3. Air leakage of building envelope assemblies shall comply with Section C402.5.

SDCI Informative Note: For the application of the building envelope requirements to elevator shafts and stair enclosures, see the definition of *conditioned space* in Chapter 2 and the exception to Section C402.1.3.

C402.1.1 Low energy buildings, semi-heated buildings and greenhouses. Low energy buildings shall comply with Section C402.1.1.1. Semi-heated buildings and spaces shall comply with Section C402.1.1.2. Greenhouses shall comply with Section C402.1.1.3.

C402.1.1.1 Low energy buildings. The following buildings, or enclosed portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from all thermal envelope provision of this code:

1. Those that are heated and/or cooled with a peak design rate of energy usage less than 3.4 Btu/h × ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.

2. Those that do not contain *conditioned space*.
3. Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

C402.1.1.2 Semi-heated buildings and spaces. The building envelope of *semi-heated* buildings, or portions thereof, shall comply with the same requirements as that for conditioned spaces in Section C402, except as modified by this section. The total installed output capacity of mechanical space conditioning systems serving a *semi-heated* building or space shall comply with Section C202, except as modified by this section. Building envelope assemblies separating conditioned space from *semi-heated space* shall comply with exterior envelope insulation requirements. *Semi-heated spaces* are not required to comply with the opaque wall insulation provisions of Section ((~~C402.2.3~~)) C402.2.2 for walls that separate *semi-heated* spaces from the exterior or low energy spaces. Fenestration that forms part of the *building thermal envelope* enclosing semi-heated spaces shall comply with Section C402.4. *Semi-heated spaces* shall be calculated separately from other conditioned spaces for compliance purposes.

Opaque walls in *semi-heated* spaces shall be calculated as fully code compliant opaque walls for both the target and proposed for the Target UA calculations for Component Performance compliance per Section C402.1.5, and for the Baseline Building Design for Total Building Performance compliance per Section C407. The capacity of heat trace temperature maintenance systems complying with Section C404.7.2 that are provided for freeze protection of piping and equipment only shall not be included in the total installed output capacity of mechanical space conditioning systems.

EXCEPTION: Provided the total installed heating output capacity of mechanical space conditioning does not exceed the criteria for semi-heated space as defined in Section C202, a semi-heated building or space is permitted to comply with this section when served by heat pumps without electric resistance back up and connected to a heating only thermostat.

SDCI Informative Note: There is no separate "freeze protection" space conditioning category for unoccupied utility buildings. Spaces with no cooling and less than 3.4 BTU/h-ft^2 heating capacity are not required to be insulated. The opaque walls of spaces that meet the definition of "semiheated" in Chapter 2 are not required to be insulated, but otherwise the thermal envelope of semiheated spaces must meet all requirements for *conditioned space*. Spaces with any mechanical cooling or with more than 8 BTU/h-ft^2 heating capacity must meet all the *building thermal envelope* requirements for *conditioned space*.

C402.1.1.3 Greenhouses. *Greenhouse* structures or areas that comply with all of the following shall be exempt from the building envelope requirements of this code:

1. Exterior opaque envelope assemblies complying with Sections C402.2 and C402.4.4.

   EXCEPTION: Low energy greenhouses that comply with Section C402.1.1.1.
2. Interior partition building thermal envelope assemblies that separate the *greenhouse* from conditioned space complying with Sections C402.2, C402.4.3 and C402.4.4.
3. Fenestration assemblies complying with the thermal envelope requirements in Table C402.1.1.3. The *U*-factor for the skylight shall be for the roof assembly or a roof that includes the assembly and an internal curtain system.

   EXCEPTION: Unheated *greenhouses*.
4. No mechanical cooling is provided.
5. For heated greenhouses, heating is provided by a radiant heating system, a condensing natural gas-fired or condensing propane-fired heating system, or a heat pump with cooling capacity permanently disabled as preapproved by the jurisdiction.

Table C402.1.1.3
Fenestration Thermal Envelope Maximum Requirements

Component	*U*-Factor BTU/h-ft^2-°F
Skylights	0.5
Vertical fenestration	0.6

C402.1.2 Equipment buildings. Buildings that comply with all of the following shall be exempt from the building thermal envelope provisions of this code:

1. Are separate buildings with floor area no more than 500 square feet (50 m^2).
2. Are intended to house electric equipment with installed equipment power totaling at least 7 watts per square foot (75 W/m^2) and not intended for human occupancy.
3. Are served by mechanical cooling and heating systems sized in accordance with Sections C403.1.2 and C403.3.1.
4. Have a heating system capacity not greater than 17,000 Btu/hr (5 kW) and a heating thermostat set point that is restricted to not more than 50°F (10°C).

5. Have an average wall and roof *U*-factor less than 0.200.

EXCEPTION: Where the cooling and heating system is a heat pump, the heating capacity is allowed to exceed 17,000 Btu/h provided the heat pump cooling efficiency is at least 15 percent better than the requirements in Tables C403.3.2(2) and C403.3.2(14).

C402.1.2.1 Standalone elevator hoistways. Elevator hoistways that comply with all of the following shall be exempt from the building thermal envelope and envelope air barrier provisions of this code:

1. Are separate from any other conditioned spaces in the building (do not serve or open into any conditioned, semi-heated or indirectly conditioned space).
2. Have heating and/or cooling equipment sized only to serve the expected elevator loads with thermostat setpoints restricted to heating to no higher than 40°F and cooling to no lower than 95°F.
3. Have an area weighted average wall, roof and floor (where applicable) *U*-factor of less than or equal to 0.20. Calculations must include any floor-slab-edges that penetrate the hoistway and thus are considered part of the above-grade walls.

Table C402.1.3
Opaque Thermal Envelope Insulation Component
Minimum Requirements, *R-value* Method[a, ((i)) i]

CLIMATE ZONE	5 AND MARINE 4	
	All Other	Group R
Roofs		
Insulation entirely above deck	R-38ci	R-38ci
Metal buildings[b]	R-25 + R-22 LS	R-25 + R-22 LS
Attic and other	R-49	R-49
Walls, Above Grade[i]		
Mass[h]	((~~R-9.5cie~~)) Exterior: R-16 c.i. Interior: R-13 + R-6 ci wood stud, or R-13 + R-10 ci metal stud	((~~R-13.3ci~~)) Exterior: R-16 c.i. Interior: R-13 + R-6 ci wood stud, or R-13 + R-10 ci metal stud
Interior:		
R-13 + R-6 ci wood stud, or		
R-13 + R-10 ci metal stud	Exterior: R-16 c.i.	
Interior:		
R-13 + R-6 ci wood stud, or		
R-13 + R-10 ci metal stud		
Mass transfer deck slab edge	N/R	N/R
Metal buildings	R-13 + R-14ci	R-13 + R-14ci
Steel framed	R-13 + R-10ci	R-19 + R-8.5ci
Wood framed and other	R-13 + R-7.5ci std or R-20 + R-3.8ci std or R-25 std	R-13 + R-7.5ci std or R-20 + R-3.8ci std or R-25 std
Walls, Below Grade		
Below-grade wall[d,h]	((~~Same as above grade~~)) Exterior: R-10 ci Interior: R-19 wood stud, or R-13 + R-6 ci metal stud	((~~Same as above grade~~)) Exterior: R-10 ci Interior: R-19 wood stud, or R-13 + R-6 ci metal stud
Floors		
Mass[f]	R-30ci	R-30ci
Joist/framing	Steel frame: R-38 +R-10 ci Wood frame: R-38	Steel frame: R-38 +R-10 ci Wood frame: R-38
Slab-on-Grade Floors		
Unheated slabs	R-10 for 24" below	R-10 for 24" below
Heated slabs	R-10 perimeter & under entire slab	R-10 perimeter & under entire slab

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner system—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a Assembly descriptions can be found in Chapter 2 and Appendix A.

b Where using *R*-value compliance method, a thermal spacer block with minimum thickness of 1/2-inch and minimum *R*-value of R-3.5 shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c (Reserved) ((~~**Exception:** Integral insulated concrete block walls complying with ASTM C90 with all cores filled and meeting both of the following: At least 50 percent of cores must be filled with vermiculite or equivalent fill insulation; and~~
~~The building thermal envelope encloses one or more of the following uses: Warehouse (storage and retail), gymnasium, auditorium, church chapel, arena, kennel, manufacturing plant, indoor swimming pool, pump station, water and waste water treatment facility, storage facility, storage area, motor vehicle service facility. Where additional uses not listed (such as office, retail, etc.) are contained within the building, the exterior walls that enclose these areas may not utilize this exception and must comply with the appropriate mass wall R-value from Table C402.1.3/U-factor from Table C402.1.4.~~))

d Where heated slabs are below grade, they shall comply with the insulation requirements for heated slabs.

e (Reserved)

f "Mass floors" shall include floors weighing not less than:

1. 35 pounds per square foot of floor surface area; or
2. 25 pounds per square foot of floor surface area where the material weight is not more than 120 pounds per cubic foot.

g Component performance in accordance with Section C402.1.5 shall be required for buildings with a mass transfer deck slab.

h Peripheral edges of intermediate concrete floors are included in the above-grade mass wall category and therefore must be insulated as above-grade mass walls unless they meet the definition of Mass Transfer Deck Slab Edge. The area of the peripheral edges of concrete floors shall be defined as the thickness of the slab multiplied by the perimeter length of the edge condition. See Table A103.3.7.2 for typical default *U*-factors for above-grade slab edges and footnote c for typical conditions of above-grade slab edges.

i Where the total area of through-wall mechanical equipment is greater than 1 percent of the opaque *above-grade wall area*, use of the *R*-value method is not permitted. See Section C402.1.4.3.

j For roof, wall or floor assemblies where the proposed assembly would not be *continuous insulation*, alternate nominal *R*-value compliance options for assemblies with isolated metal fasteners that penetrate otherwise *continuous insulation* are as shown in columns B and C of Table C402.1.3(i):

Table C402.1.3(i)
Continuous Insulation Equivalents

Column A	Column B	Column C
Assemblies with continuous insulation (see definition)	**Alternate option for assemblies with metal penetrations, greater than 0.04% but less than 0.08%**	**Alternate option for assemblies with metal penetrations, greater than or equal to 0.08% but less than 0.12%**
R-9.5ci	R-11.9ci	R-13ci
R-11.4ci	R-14.3ci	R-15.7ci
R-13.3ci	R-16.6ci	R-18.3ci
R-15.2ci	R-19ci	R-21ci
R-30ci	R-38ci	R-42ci
R-38ci	R-48ci	R-53ci
R-13 + R-7.5ci	R-13 + R-9.4ci	R-13 + R-10.3ci
R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-13.8ci
R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-17.2ci
R-13 + R-13ci	R-13 + R-16.3ci	R-13 + R-17.9ci
R-19 + R-8.5ci	R-19 + R-10.6ci	R-19 + R-11.7ci
R-19 + R-14ci	R-19 + R-17.5ci	R-19 + R-19.2ci
R-19 + R-16ci	R-19 + R-20ci	R-19 + R-22ci
R-20 + R-3.8ci	R-20 + R-4.8ci	R-20 + R-5.3ci
R-21 + R-5ci	R-21 + R-6.3ci	R-21 + R-6.9ci

Notes for Table C402.1.3(i)

These alternate nominal *R*-value compliance options are allowed for projects complying with all of the following:

1a. The ratio of the cross-sectional area, as measured in the plane of the surface, of metal penetrations of otherwise continuous insulation to the opaque surface area of the assembly is greater than 0.0004 (0.04%), but less than 0.0008 (0.08%), for use of Column B equivalents, and greater than or equal to 0.008 (0.08%), but less than 0.0012 (0.12%), for use of Column C equivalents.

1b. Where all metal penetrations are stainless steel, Column B is permitted to be used for penetrations greater than 0.12%, but less than 0.24% of opaque surface area, and Column C is permitted to be used for penetrations greater than or equal to 0.24%, but less than 0.48% of opaque surface area.

2. The metal penetrations of otherwise continuous insulation are isolated or discontinuous (e.g., brick ties or other discontinuous metal attachments, offset brackets supporting shelf angles that allow insulation to go between the shelf angle and the primary portions of the wall structure). No continuous metal elements (e.g., metal studs, z-girts, z-channels, shelf angles) penetrate the otherwise continuous portion of the insulation.

3. Building permit drawings shall contain details showing the locations and dimensions of all the metal penetrations (e.g., brick ties or other discontinuous metal attachments, offset brackets, etc.) of otherwise continuous insulation. In addition, calculations shall be provided showing the ratio of the cross-sectional area of metal penetrations of otherwise continuous insulation to the overall opaque wall area.

   For other cases where the proposed assembly is not continuous insulation, see Section C402.1.4 for determination of *U*-factors for assemblies that include metal other than screws and nails.

C402.1.3 Insulation component *R-value*-based method. *Building thermal envelope* opaque assemblies shall comply with the requirements of Section C402.2 based on the climate zone specified in Chapter 3. For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R-value* basis, the *R-values* for cavity insulation and continuous insulation shall not be less than that specified in Table C402.1.3. Where cavity insulation is installed in multiple layers, the cavity insulation *R*-values shall be summed to determine compliance with the cavity insulation *R*-value requirements. Where continuous insulation is installed in multiple layers, the continuous insulation *R*-values shall be summed to determine compliance with the continuous insulation *R*-value requirements. Cavity insulation *R*-values shall not be used to determine compliance with the continuous insulation *R*-value requirements in Table C402.1.3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.1.3. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.1.3.

EXCEPTION: For stair and elevator shafts that do not comply with Section C402.1.2.1 and that are located within enclosed garages or other enclosed non-conditioned spaces and without conditioned supply air or cooling or heating appliances rated higher than 2 kW in any shaft, walls enclosing the shafts are permitted to be:

1. Concrete or masonry with minimum R-5 *continuous insulation*;
2. Metal studs with R-15 *cavity insulation* and without *continuous insulation*; or
3. Other assemblies with a maximum U-value of 0.120.

Slab floors, intermediate mass floor edges and elevator pits within shafts using this exception are excluded from envelope insulation requirements. Shaft surfaces using this exception shall not be included in the gross exterior wall area for purposes of maximum fenestration area calculations in Section C402.4.1 component performance calculations in Section C402.1.5, or for the total building performance calculation of Section C407.

C402.1.4 Assembly *U*-factor, *C*-factor, or *F*-factor-based method. Building thermal envelope opaque assemblies shall meet the requirements of Section C402.2 based on the climate zone specified in Chapter 3. Building thermal envelope opaque assemblies intended to comply on an assembly *U*-, *C*-, or *F*-factor basis shall have a *U*-, *C*-, or *F*-factor not greater than that specified in Table C402.1.4. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-, *C*-, or *F*-factor from the "Group R" column of Table C402.1.4. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-, *C*-, or *F*-factor from the "All other" column of Table C402.1.4. The *U*-factors for typical construction assemblies are included in Appendix A. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Appendix A, values shall be calculated in accordance with the ASHRAE *Handbook—Fundamentals* using the framing factors listed in Appendix A where applicable and shall include the thermal bridging effects of framing materials.

C402.1.4.1 Roof/ceiling assembly. The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

C402.1.4.1.1 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling construction.

C402.1.4.1.2 Joints staggered. Continuous insulation board shall be installed not less than two layers, and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain, or scupper.

C402.1.4.2 Thermal resistance of cold-formed steel stud walls. *U*-factors of walls with cold-formed steel studs shall be permitted to be determined either by using the values in Table C402.1.4.2, or in accordance with Equation 4-1:

$$U = 1/[Rs + (ER)] \qquad \textbf{(Equation 4-1)}$$

Where:

Rs = The cumulative *R-value* of the wall components along the path of heat transfer, excluding the cavity insulation and steel studs.

ER = The effective *R-value* of the cavity insulation with steel studs as specified in Table C402.1.4.2.

C402.1.4.3 Thermal resistance of mechanical equipment penetrations. When the total area of penetrations from through-wall mechanical equipment or equipment listed in Table C403.3.2(4) exceeds 1 percent of the opaque *above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U*-factor of 0.5. Mechanical system ducts and louvers, including those for supply, exhaust and relief, and for condenser air intake and outlet, are not considered to be mechanical equipment for the purposes of this section.

EXCEPTION: Where mechanical equipment has been tested in accordance with *approved* testing standards, the mechanical equipment penetration area is permitted to be calculated as a separate wall assembly using the *U*-factor determined by such test.

Table C402.1.4
Opaque Thermal Envelope Requirements[a,f]

CLIMATE ZONE	5 AND MARINE 4	
	All Other	Group R
Roofs		
Insulation entirely above deck	U-0.027	U-0.027
Metal buildings	((~~U-0.031~~)) U-0.027	((~~U-0.031~~)) U-0.027
Attic and other	U-0.021	U-0.021
Joist or single rafter	U-0.027	U-0.027
Walls, Above Grade[k]		
Mass[g]	((~~U-0.104~~[d])) U-0.057	((~~U-0.078~~)) U-0.057
Mass transfer deck slab[i]	U-0.20	U-0.20
Slab penetrating thermal envelope wall[h]	U-0.10	U-0.10
Metal building	U-0.050	U-0.050
Steel framed	U-0.055	U-0.055
Wood framed and other	U-0.051	U-0.051
Walls, Below Grade		
Below-grade wall[b, g]	((~~Same as above grade~~)) U-0.070	((~~Same as above grade~~)) U-0.070
Floors		
Mass[e]	U-0.031	U-0.031
Joist/framing	((~~U-0.029~~)) U-0.029 steel joist U-0.025 wood joist	((~~U-0.029~~)) U-0.029 steel joist U-0.025 wood joist
Concrete column or concrete wall penetrating thermal envelope floor[l]	U-0.55	U-0.55
Concrete slab floor directly above an electrical utility vault	N.R.	N.R.
Slab-on-Grade Floors		
Unheated slabs	F-0.54	F-0.54
Heated slabs[c]	F-0.55	F-0.55
Opaque Doors		
Nonswinging door	U-0.31	U-0.31
Swinging door[h]	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31
Garage door ≥14% and <50% glazing[i]	U-0.34	U-0.34

a Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from Appendix A is required unless otherwise allowed by Section C402.1.4.

b (Reserved) ((~~Where heated slabs are below grade, they shall comply with the *F*-factor requirements for heated slabs.~~))

c Heated slab *F*-factors shall be determined specifically for heated slabs. Unheated slab factors shall not be used.

d (Reserved) ((~~**Exception:** Integral insulated concrete block walls complying with ASTM C90 with all cores filled and meeting both of the following: At least 50 percent of cores must be filled with vermiculite or equivalent fill insulation; and The building thermal envelope encloses one or more of the following uses: Warehouse (storage and retail), gymnasium, auditorium, church chapel, arena, kennel, manufacturing plant, indoor swimming pool, pump station, water and waste water treatment facility, storage facility, storage area, motor vehicle service facility. Where additional uses not listed (such as office, retail, etc.) are contained within the building, the exterior walls that enclose these areas may not utilize this exception and must comply with the appropriate mass wall R-value from Table C402.1.3/U-factor from Table C402.1.4.~~))

e "Mass floors" shall include floors weighing not less than:
1. 35 pounds per square foot of floor surface area; or
2. 25 pounds per square foot of floor surface area where the material weight is not more than 120 pounds per cubic foot.

f Opaque assembly *U*-factors based on designs tested in accordance with ASTM C1363 shall be permitted. The *R*-value of continuous insulation shall be permitted to be added or subtracted from the original test design.

g Peripheral edges of intermediate concrete floors are included in the above-grade mass wall category and therefore must be insulated as above-grade mass walls unless they meet the definition of *Mass Transfer Deck Slab*. The area of the peripheral edges of concrete floors shall be defined as the thickness of the slab multiplied by the perimeter length of the edge condition. See Table A103.3.7.2 for typical default *U*-factors for above-grade slab edges and footnote c for typical conditions of above-grade slab edges.

h Swinging door *U*-factors shall be determined in accordance with NFRC-100.

i Garage doors having a single row of *fenestration* shall have an assembly *U*-factor less than or equal to 0.44, provided that the *fenestration* area is not less than 14 percent and not more than 25 percent of the total door area.

j Component performance in accordance with Section C402.1.5 shall be required for buildings with a mass transfer deck slab. A mass transfer deck, due to its configuration, is not insulated. The table value (U-0.20) shall be used as the baseline value for component performance or total building performance path calculations. For the proposed value, the appropriate value from Table ((~~A104.3.7.2~~)) A103.3.7.2 shall be used.

k Through-wall mechanical equipment subject to Section C402.1.4.3 shall be calculated at the U-factor defined in Section C402.1.4.3. The area-weighted U-factor of the wall, including through-wall mechanical equipment, shall not exceed the value in the table.

l Value applies to concrete columns and concrete walls that interrupt mass floor insulation, but not to perimeter walls or columns separating interior conditioned space from exterior space.

Table C402.1.4.2
Effective *R*-values For Steel Stud Wall Assemblies

NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY *R*-VALUE (insulation)	CORRECTION FACTOR (*Fc*)	EFFECTIVE *R*-VALUE (ER) (Cavity *R*-Value × *Fc*)
3-1/2	16	13	0.46	5.98
		15	0.43	6.45
3-1/2	24	13	0.55	7.15
		15	0.52	7.80
6	16	19	0.37	7.03
		21	0.35	7.35
6	24	19	0.45	8.55
		21	0.43	9.03
8	16	25	0.31	7.75
	24	25	0.38	9.50

C402.1.5 Component performance alternative. Building envelope values and fenestration areas determined in accordance with Equation 4-2 shall be permitted in lieu of compliance with the *U*-factors and *F*-factors in Table C402.1.4 and C402.4 and the maximum allowable fenestration areas in Section C402.4.1.

For buildings with more than one *space conditioning category*, component performance compliance shall be demonstrated separately for each space conditioning category. Interior partition ceilings, walls, fenestration and floors that separate space conditioning areas shall be applied to the component performance calculations for the space conditioning category with the highest level of space conditioning.

$$\text{Proposed Total UA} \leq \text{Allowable Total UA} \qquad \textbf{(Equation 4-2)}$$

Where:

Proposed Total UA	=	UA-glaz-prop + UA sky-prop + UA-opaque-prop + FL-slab-prop
Allowable Total UA	=	UA-glaz-allow + UA-glaz-excess + UA sky-allow + UA-sky-excess + UA-opaque-allow + FL-slab-allow
UA-glaz-prop	=	Sum of (proposed *U*-value × proposed area) for each distinct vertical fenestration type, up to code maximum area
UA-sky-prop	=	Sum of (proposed *U*-value × proposed area) for each distinct skylight type, up to the code maximum area
UA-opaque-prop	=	Sum of (proposed *U*-value × proposed area) for each distinct opaque thermal envelope type
FL-slab-prop	=	Sum of (proposed *F*-value × proposed length) for each distinct slab on grade perimeter assembly
UA-glaz-allow	=	Sum of (code maximum vertical fenestration *U*-value from Table C402.4, or Section C402.4.1.1.2 if applicable, × proposed area) for each distinct vertical fenestration type, not to exceed the code maximum area[1]
UA-glaz-excess	=	*U*-value for the proposed wall type from Table C402.4[2] × vertical fenestration area in excess of the code maximum area
UA-sky-allow	=	Sum of (code maximum skylight *U*-value from Table C402.4 × proposed area) for each distinct skylight type proposed, not to exceed the code maximum area
UA-sky-excess	=	*U*-value for the proposed roof type from Table C402.4[3] × skylight area in excess of the code maximum area
UA-opaque-allow	=	Code maximum opaque envelope *U*-value from Table C402.1.4 for each *opaque door*, wall, roof, and floor assembly × proposed area
FL-slab-allow	=	Code maximum *F*-value for each slab-on-grade perimeter assembly × proposed length

Notes:

1 Where multiple vertical fenestration types are proposed and the code maximum area is exceeded, the *U*-value shall be the average Table C402.1.4 *U*-value weighted by the proposed vertical fenestration area of each type.

2 Where multiple wall types are proposed the *U*-value shall be the average Table C402.1.4 *U*-value weighted by the proposed above grade wall area of each type.
3 Where multiple roof types are proposed the *U*-value shall be the average Table C402.1.4 *U*-value weighted by the proposed roof area of each type.

C402.1.5.1 Component *U*-factors and *F*-factors. The *U*-factors and *F*-factors for typical construction assemblies are included in Chapter 3 and Appendix A. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Chapter 3 or Appendix A, values shall be calculated in accordance with the ASHRAE *Handbook—Fundamentals*, using the framing factors listed in Appendix A.

For envelope assemblies containing metal framing, the *U*-factor shall be determined by one of the following methods:

1. Results of laboratory measurements according to acceptable methods of test.
2. ASHRAE *Handbook—Fundamentals* where the metal framing is bonded on one or both sides to a metal skin or covering.
3. The zone method as provided in ASHRAE *Handbook—Fundamentals*.
4. Effective framing/cavity *R*-values as provided in Appendix A.

   When return air ceiling plenums are employed, the roof/ceiling assembly shall:

   a. For thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and
   b. For gross area purposes, be based upon the interior face of the upper plenum surface.
5. Tables in ASHRAE 90.1 Normative Appendix A.
6. Calculation method for steel-framed walls in accordance with Section ((~~C402.1.4.1~~)) C402.1.4.2 and Table ((~~C402.1.4.1~~)) C402.1.4.2.

C402.1.5.2 SHGC rate calculations. Fenestration SHGC values for individual components and/or fenestration are permitted to exceed the SHGC values in Table C402.4 and/or the maximum allowable fenestration areas in Section C402.4.1 where the proposed total SHGCxA less than the allowable total SHGCxA as determined by Equation 4-3.

$$\text{Proposed Total SHGCxA} \leq \text{Allowable Total SHGCxA} \qquad \textbf{(Equation 4-3)}$$

Where:

Proposed Total SHGCxA	=	SHGCxA-glaz-prop + SHGCxA-sky-prop
Allowable Total SHGCxA	=	SHGCxA-glaz-allow + SHGCxA-sky-allow
SHGCxA-glaz-prop	=	Sum of (proposed SHGCx proposed area) for each distinct vertical fenestration type
SHGCxA-sky-prop	=	Sum of (proposed SHGCx proposed area) for each distinct skylight type
SHGCxA-glaz-allow	=	Sum of (code maximum vertical fenestration SHGC from Table C402.4, or Section C402.4.1.3 if applicable, × proposed area) for each distinct vertical fenestration type, not to exceed the code maximum area
SHGCxA-sky-allow	=	Sum of (code maximum skylight SHGC from Table C402.4 × proposed area) for each distinct skylight type, not to exceed the code maximum area

If the proposed vertical fenestration area does not exceed the Vertical Fenestration Area allowed, the target area for each vertical fenestration type shall equal the proposed area. If the proposed vertical fenestration area exceeds the Vertical Fenestration Area allowed, the target area of each vertical fenestration element shall be reduced in the base envelope design by the same percentage and the net area of each above-grade wall type increased proportionately by the same percentage so that the total vertical fenestration area is exactly equal to the Vertical Fenestration Area allowed.

If the proposed skylight area does not exceed the Allowable Skylight Area from Section C402.4.1, the target area shall equal the proposed area. If the proposed skylight area exceeds the Allowable Skylight Area from Section C402.4.1, the area of each skylight element shall be reduced in the base envelope design by the same percentage and the net area of each roof type increased proportionately by the same percentage so that the total skylight area is exactly equal to the allowed percentage per Section C402.3.1 of the gross roof area.

C402.2 Specific building thermal envelope insulation requirements. Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through ((~~C402.2.8~~)) C402.2.9 and Table C402.1.3.

Where this section refers to installing insulation levels as specified in Section C402.1.3, assemblies complying prescriptively with Section C402.1.4 and buildings complying with Section C402.1.5 are allowed to install alternate levels of insulation so long as the *U*-factor of the insulated assembly is less than or equal to the *U*-factor required by the respective path.

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly.

EXCEPTIONS:

1. Where tapered insulation is used with insulation entirely above deck, those roof assemblies shall show compliance on a *U*-factor basis per Section C402.1.4. The effective *U*-factor shall be determined through the use of Tables A102.2.6(1), A102.2.6(2) and A102.2.6(3).
2. Two layers of insulation are not required where insulation tapers to the roof deck, such as at roof drains. At roof drains, the immediate 24 inch by 24 inch plan area around each roof drain has a minimum insulation requirement of R-13, but otherwise is permitted to be excluded from the roof insulation area-weighted calculations.

C402.2.1.1 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm).

C402.2.1.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling construction.

C402.2.1.3 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

EXCEPTION: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

C402.2.1.4 Rooftop HVAC equipment curbs. Structural curbs installed to support rooftop HVAC equipment are allowed to interrupt the above roof insulation. The area under the HVAC equipment inside of the equipment curb shall be insulated to a minimum of R-13 in all locations where there are not roof openings for ductwork. The annular space between the roof opening and the ductwork shall be sealed to maintain the building air barrier. The plan-view area of the HVAC equipment curb shall be excluded from the prescriptive roof insulation requirements or the area-weighted component performance calculations.

C402.2.2 Above-grade walls. The minimum thermal resistance (*R*-value) of materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.1.3, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.1.3 except as otherwise noted in the table. In determining compliance with Table C402.1.4, the use of the *U*-factor of concrete masonry units with integral insulation shall be permitted.

"Mass walls" where used as a component in the thermal envelope of a building shall comply with one of the following:

1. Weigh not less than 35 psf (170 kg/m^2) of wall surface area.
2. Weigh not less than 25 psf (120 kg/m^2) of wall surface area where the material weight is not more than 120 pounds per cubic foot (pcf) (1,900 kg/m^3).
3. Have a heat capacity exceeding 7 Btu/ft^2 × °F (144 kJ/m^2 × K).
4. Have a heat capacity exceeding 5 Btu/ft^2 × °F (103 kJ/m^2 × K) where the material weight is not more than 120 pcf (1900 kg/m^3).

C402.2.3 Floors. The thermal properties (component *R*-values or assembly *U*- or *F*-factors) of floor assemblies over outdoor air or unconditioned space shall be as specified in Table C402.1.3 or C402.1.4 based on the construction materials used in the floor assembly. Floor framing cavity insulation or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.

"Mass floors" where used as a component of the thermal envelope of a building shall provide one of the following weights:

1. Thirty-five pounds per square foot of floor surface area;
2. Twenty-five pounds per square foot of floor surface area where the material weight is not more than 120 pounds per cubic foot.

EXCEPTIONS:

1. The floor framing cavity insulation or structural slab insulation shall be permitted to be in contact with the top side of sheathing or continuous insulation installed on the bottom side of floor assemblies where combined with insulation that meets or exceeds the minimum *R*-value in Table C402.1.3 for "Metal framed" or "Wood framed and other" values for "Walls, Above Grade" and extends from the bottom to the top of all perimeter floor framing or floor assembly members.

2. Insulation applied to the underside of concrete floor slabs shall be permitted an air space of not more than 1 inch where it turns up and is in contact with the underside of the floor under walls associated with the *building thermal envelope*.

C402.2.4 Slabs-on-grade. The minimum thermal resistance (R-value) of the insulation for unheated or heated slab-on-grade floors designed in accordance with the R-value method of Section C402.1.3 shall be as specified in Table C402.1.3.

C402.2.4.1 Insulation installation. Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

EXCEPTION: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C402.2.5 Below-grade walls. The *R*-value of the insulating material installed in, or continuously on, the below-grade walls shall be in accordance with Table C402.1.3. The *U*-factor or *R*-value required shall extend to the level of the lowest floor of the conditioned space enclosed by the below-grade wall.

C402.2.6 Insulation of radiant heating systems. *Radiant heating system* panels, and their associated components that are installed in interior or exterior assemblies shall be insulated to an *R*-value of not less than R-3.5 on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the *R*-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.4.

EXCEPTION: Heated slabs on grade insulated in accordance with Section C402.2.4.

C402.2.7 Airspaces. Where the R-value of an airspace is used for compliance in accordance with Section C401.2, the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous air barrier and is bounded on all sides by building components.

EXCEPTION: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at a minimum air movement rate of not less than 70 mm/sec.

C402.2.8 Above-grade exterior concrete slabs. Above-grade concrete slabs that penetrate the *building thermal envelope* including, but not limited to, decks and balconies, shall each include a minimum R-10 thermal break, aligned with the primary insulating layer in the adjoining wall assemblies. Stainless steel (but not carbon steel) reinforcing bars are permitted to penetrate the thermal break. If the total building performance path or the component performance alternative in Section C402.1.5 is utilized and the thermal break required by this section is not provided where concrete slabs penetrate the *building thermal envelope*, the sectional area of the penetration shall be assigned the default *U*-factors from the "exposed concrete" row of Table A103.3.7.2.

EXCEPTION: *Mass transfer deck slabs*.

C402.2.9 Vertical fenestration intersection with opaque walls. *Vertical fenestration* shall comply with Items 1, 2, and 3, as applicable.

1. Where wall assemblies include *continuous insulation*, the exterior glazing layer of *vertical fenestration* and any required thermal break in the frame shall each be aligned within 2 inches laterally of either face of the *continuous insulation* layer.
2. Where wall assemblies do not include *continuous insulation*, the exterior glazing layer of *vertical fenestration* and any required thermal break in the frame shall each be aligned within the thickness of the *wall* insulation layer and not more than 2 inches laterally from the exterior face of the outermost insulation layer.
3. Where the exterior face of the *vertical fenestration* frame does not extend to the exterior face of the opaque wall rough opening, the exposed exterior portion of the rough opening shall be covered with either a material having an *R*-value not less than R-3, or with minimum 1.5-inch thickness wood.

C402.3 Reserved.

C402.4 Fenestration. Fenestration shall comply with Sections C402.4 through C402.4.4 and Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.5.

EXCEPTION:

1. For prescriptive envelope compliance, single-pane glazing is permitted for security purposes and for revolving doors, not to exceed 1 percent of the gross exterior wall area. Where Section C402.1.5, component performance alternative, is used, the single glazing shall be included in the percentage of the total glazing area, U-factor and SHGC requirements.

Table C402.4
Building Envelope Fenestration Maximum *U*-factor and SHGC Requirements[f]

CLIMATE ZONE	5 AND MARINE 4	
	***U*-factor for Class AW windows rated in accordance with AAMA/CSA101/I.S.2/A440, vertical curtain walls and site-built fenestration products[a]**	
Fixed[b] *U*-factor	U-0.34	
Operable[c] *U*-factor	U-0.36	
***Entrance doors*[d]**		
U-factor	U-0.60	
	***U*-factor for all other vertical fenestration**	
Fixed *U*-factor	U-0.26	
Operable or mulled windows with fixed and operable sections *U*-factor	U-0.28	
SHGC for all vertical fenestration		
	Fixed	Operable
PF < 0.2	0.38	0.33
0.2 ≤ PF < 0.5	0.46	0.40
PF ≥ 0.5	0.61	0.53
Skylights		
U-factor	((~~U-0.50~~)) U-0.45	
SHGC	((~~0.35~~)) 0.32	

a *U*-factor and SHGC shall be rated in accordance with NFRC 100.
b "Fixed" includes curtain wall, storefront, picture windows, and other fixed windows.
c "Operable" includes openable fenestration products other than "entrance doors," and includes only the operable portions of multi-pane assemblies.
d "Entrance door" includes glazed *swinging* entrance doors and *automatic* glazed sliding *entrance doors*. Other doors which are not entrance doors, including manually operated sliding glass doors, are considered "operable."
e Reserved.
f Fenestration that is entirely within the conditioned space or is between conditioned and other enclosed space is exempt from solar heat gain coefficient requirements and not included in the SHGC calculation.

SDCI Informative Note: The category at the top of Table C402.4, labeled "*U-factor for Class AW windows rated in accordance with AAMA/CSA101/I.S.2/A440, vertical curtain walls and site-built fenestration products*," includes *curtain wall*, storefront, ribbon wall, window wall, and similar site-assembled systems, but does not include typical punched-opening manufactured windows except for "Class AW" windows. Class AW is the AAMA designation for windows typically used in mid-rise and high-rise buildings to resist high wind and water intrusion loads.

C402.4.1 Maximum area. The total building vertical fenestration area (not including *opaque doors* and opaque spandrel panels) shall not exceed 30 percent of the total building gross above-grade wall area. The skylight area shall not exceed 5 percent of the total building gross roof area (skylight-to-roof ratio).

For buildings with more than one *space conditioning category*, compliance with the maximum allowed window-to-wall ratio and skylight-to-roof ratio shall be demonstrated separately for each *space conditioning category*. Interior partition ceiling, wall, fenestration and floor areas that separate space conditioning areas shall not be applied to the window-to-wall ratio and skylight-to-roof ratio calculations.

EXCEPTIONS:

1. For vertical fenestration at street level retail or for other occupancies where the Seattle Land Use Code requires street-level transparency, the vertical fenestration area shall not exceed 75 percent of the area of the street-level wall that faces the street or that adjoins other pedestrian areas used for retail access. For the purposes of this exception, the street-level wall shall be measured from the street-level floor to the interior ceiling level or to 20 feet above floor level, whichever is lowest. When this exception is used, separate calculations shall be performed for these sections of the building envelope, and these values shall not be averaged with any others for compliance

purposes. On the street level the 75 percent vertical fenestration area is permitted to be exceeded, if the additional fenestration area is deducted from fenestration allowances from other areas of the building.

2. Accessory occupancy areas that comprise less than 10 percent of the conditioned floor area of any floor are permitted to be included in the primary occupancy of that floor for determination of the allowable fenestration area for that floor.

C402.4.1.1 Vertical fenestration maximum area with high performance alternates. For buildings that comply with Section C402.4.1.1.1 or C402.4.1.1.2, the total building vertical fenestration area is permitted to exceed 30 percent but shall not exceed 40 percent of the total building gross above grade wall area for the purpose of prescriptive compliance with Section C402.1.4.

When determining compliance using the component performance alternative in accordance with Section C402.1.5, the total building vertical fenestration area allowed in Equation 4-2 (UA-glaz-allow) is 40 percent of the above grade wall area for buildings that comply with the vertical fenestration alternates described in this section.

C402.4.1.1.1 Optimized daylighting. All of the following requirements shall be met:

1. Not less than 50 percent of the total conditioned floor area in the building is within a *daylight zone* that includes *daylight responsive controls* complying with Section C405.2.5.1.
2. Visible transmittance (VT) of all *vertical fenestration* in the building is greater than or equal to 1.1 times the required solar heat gain coefficient (SHGC) in accordance with Section C402.4, or 0.50, whichever is greater. It shall be permitted to demonstrate compliance based on the area weighted average *VT* being greater than or equal to the area weighted average of the minimum *VT* requirements.

EXCEPTION: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 2.

C402.4.1.1.2 High-performance fenestration. All of the following requirements shall be met:

1. All *vertical fenestration* in the building shall comply with the following *U*-factors:
   1.1. *U*-factor for Class AW windows rated in accordance with AAMA/CSA101/I.S.2/A440, vertical curtain walls and site-built fenestration products (fixed) = 0.31
   1.2. *U*-factor for Class AW windows rated in accordance with AAMA/CSA101/I.S.2/A440, vertical curtain walls and site-built fenestration products (operable) = 0.36
   1.3. Entrance doors = 0.60
   1.4. *U*-factor for all other vertical fenestration, fixed = 0.23
   1.5. *U*-factor for all other vertical fenestration, operable, or mulled windows with fixed and operable sections = 0.24
2. The SHGC of the vertical fenestration shall be no more than 0.9 times the maximum SHGC values listed in Table C402.4.

An area-weighted average shall be permitted to satisfy the *U*-factor requirement for each fenestration product category listed in Item 1 of this section. Individual fenestration products from different fenestration product categories shall not be combined in calculating the area-weighted average *U*-factor, except that fenestration from lines ((~~a.~~)) 1.1 and ((~~b.~~)) 1.2 are permitted to be combined, and the fenestration in lines 1.4 and 1.5 are permitted to be combined. Maximum U-factors for skylights, and maximum SHGC values for all fenestration, shall comply with Section C402.4.

C402.4.2 Minimum skylight fenestration area. Skylights shall be provided in enclosed spaces that meet all the following criteria:

1. Floor area of enclosed spaces is greater than 2,500 square feet (232 m^2).
2. Space is located directly under a roof and have a ceiling height greater than 15 feet (4572 mm) for no less than 75 percent of the ceiling area.
3. Space type is one of the following: Office, lobby, atrium, concourse, corridor, gymnasium/exercise center, convention center, automotive service, manufacturing, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation, and workshop.

Skylights in these spaces are required to provide a total toplit daylight zone area not less than 50 percent of the floor area and shall provide one of the following:

1. A minimum ratio of skylight area to toplit daylight zone area under skylights of not less than 3 percent where all skylights have a VT of at least 0.40, or VT_{annual} of not less than 0.26, as determined in accordance with Section C303.1.3.
2. A minimum skylight effective aperture, determined in accordance with Equation 4-5, of:
   2.1. Not less than 1 percent using a skylight's VT rating; or

2.2. Not less than 0.66 percent using a *tubular daylight device's* VT_{annual} rating.

Skylight Effective Aperture = (0.85 × Skylight Area × Skylight VT × WF)/Toplit daylight zone **(Equation 4-5)**

Where:

Skylight area	=	Total fenestration area of skylights.
Skylight VT	=	Area weighted average visible transmittance of skylights.
WF	=	Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater, or 1.0 for *tubular daylighting devices* (TDD) with VT_{annual} ratings measured in accordance with NFRC 203.
Light well depth	=	Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

EXCEPTIONS:

1. Skylights above daylight zones of enclosed spaces are not required in:
   1.1. Spaces designed as storm shelters complying with ICC 500.
   1.2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2) and at least 10 percent lower than the lighting power allowance in Section C405.4.2.
   1.3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.
   1.4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.
   1.5. Spaces where the total floor area minus the sidelit daylight zone area is less than 2,500 square feet (232 m^2), and where the lighting in the daylight zone is controlled in accordance with Section ((~~C405.2.3.1~~)) C405.2.4.
2. The skylight effective aperture, calculated in accordance with Equation 4-5, is permitted to be 0.66 percent in lieu of 1 percent if the VT_{annual} of the skylight or *TDD*, as measured by NFRC 203, is greater than 38 percent.

C402.4.2.1 Lighting controls in daylight zones under skylights. Daylight responsive controls shall be provided to control all electric lights within toplit daylight zones.

C402.4.2.2 Haze factor. Skylights in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store, and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D 1003.

EXCEPTION: Skylights and *tubular daylighting devices* designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles, or the geometry of skylight and light well.

C402.4.2.3 Daylight zones. Daylight zones referenced in Sections C402.4.1.1 through C402.4.2.2 shall comply with Sections C405.2.5.2 and C405.2.5.3, as applicable. Daylight zones shall include toplit daylight zones and sidelit daylight zones.

C402.4.3 Maximum *U*-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-6.

$$PF = A/B \quad \textbf{(Equation 4-6)}$$

Where:

PF	=	Projection factor (decimal).
A	=	Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
B	=	Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

C402.4.3.1 Reserved

C402.4.3.2 Reserved.

C402.4.3.3 Dynamic glazing. Where *dynamic glazing* is intended to satisfy the SHGC ((~~and VT~~)) requirements of Table C402.4, the ratio of the higher to lower labeled SHGC shall be greater than or equal to 2.4, and the *dynamic glazing* shall be automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not *dynamic glazing* shall not be permitted.

EXCEPTION: *Dynamic glazing* is not required to comply with this section where both the lower and higher labeled SHGC already comply with the requirements of Table C402.4.

C402.4.3.4 Area-weighted *U*-factor. An area-weighted average shall be permitted to satisfy the *U*-factor requirements for each fenestration product category listed in Table C402.4. Individual fenestration products from different fenestration product categories listed in Table C402.4 shall not be combined in calculating area-weighted average *U*-factor.

C402.4.4 Doors. *Opaque doors* shall be considered part of the gross area of above-grade walls that are part of the building thermal envelope, including the frame. *Opaque doors* shall comply with Table C402.1.4. Other doors shall comply with the provisions of Section C402.4.3 for vertical fenestration.

C402.5 Air leakage – thermal envelope. The thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be located on the inside or outside of the *building thermal envelope*, located within the assemblies composing the *building thermal envelope*, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

C402.5.1.1 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect, and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.
5. Construction documents shall contain a diagram showing the building's pressure boundary in plan(s) and section(s) and a calculation of the area of the pressure boundary to be considered in the test.

SDCI Informative Note: The continuous air barrier is intended to control the air leakage into and out of the *conditioned space*. The definition of *conditioned space* includes semi-heated spaces, so these spaces are included when detailing the continuous air barrier and when determining the pressure boundary for conducting the air leakage test. However, unheated spaces are not included when determining the pressure boundary.

C402.5.1.2 Air barrier compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Group R dwelling units that are accessed directly from the outdoors shall meet the provisions of Section C402.5.2.
2. All other buildings or portions of buildings shall meet the provisions of Section C402.5.3.

C402.5.2 Enclosure testing for dwelling and sleeping unit<u>s</u> accessed directly from the outdoors. For dwelling units accessed directly from outdoors, the *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.25 cfm/ft^2 (1.27 L/s m^2) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one *building thermal envelope* and are accessed directly from the outdoors, each unit shall be considered an individual test-

ing unit, and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest *testing unit enclosure area*. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of testing unit types and locations.
3. Test shall be accomplished using either a) both pressurization and depressurization or b) pressurization alone, but not depressurization alone. The test results shall be plotted against the correct P for pressurization in accordance with Section 9.4 of ASTM E779.

Where the measured air leakage rate exceeds 0.25 cfm/ft^2 (2.0 L/s × m^2) corrective action shall be taken to seal leaks in the air barrier in all units exceeding the target value and all untested units. Post-corrective action testing and repeated corrective action measures will be taken until the required air leakage rating is achieved. Final passing air leakage test results shall be submitted to the *code official*.

C402.5.3 Building thermal envelope testing. The *building thermal envelope* shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.25 cfm/ft^2 (1.27 L/s × m^2) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.
4. Test shall be accomplished using either a) both pressurization and depressurization or b) pressurization alone, but not depressurization alone. The test results shall be plotted against the correct P for pressurization in accordance with Section 9.4 of ASTM E779.

Where the measured air leakage rate exceeds 0.25 cfm/ft^2 (2.0 L/s × m^2) corrective action shall be taken to seal leaks in the air barrier. Post-corrective action testing and repeated corrective action measures will be taken until the required air leakage rating is achieved. Final passing of the air leakage test results shall be submitted to the *code official*.

C402.5.4 Building test for mixed-use buildings. Where a building is three or fewer stories above grade plane and contains both commercial and residential uses, the air barrier of the R-2 and R-3 occupancy areas of the building is permitted to be separately tested according to Section R402.4.1.2. Alternatively, it is permissible to test the air barrier of the entire building according to Section C402.5.3, provided that the tested air leakage rate does not exceed the rate specified in Section C402.5.3.

C402.5.4.1 Low-rise residential building areas conforming to commercial energy code requirements. Where the *residential building* provisions of this code require Group R-2 occupancy areas of 1, 2, and 3-story buildings to comply with the *commercial building* provisions of the code, the entire building shall be tested to meet the standards for commercial uses.

C402.5.5 Rooms containing fuel-burning appliances. Where combustion air is supplied through openings in an exterior wall to a room or space containing a space conditioning fuel-burning appliance, one of the following shall apply:

1. The room or space containing the appliance shall be located outside of the *building thermal envelope*.
2. The room or space containing the appliance shall be enclosed and isolated from conditioned spaces inside the building thermal envelope. Such rooms shall comply with all of the following:
   2.1. The walls, floor and ceiling that separate the enclosed room or space from the conditioned spaces shall be insulated to be at least equivalent to the insulation requirement of below grade walls as specified in Table C402.1.3 or C402.1.4.
   2.2. The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces be sealed in accordance with Section C402.5.1.1.
   2.3. The doors into the enclosed room or space shall be fully gasketed.
   2.4. Water lines and ducts in the enclosed room or space shall be insulated in accordance with Section C403.

2.5. Where the air duct supplying combustion air to the enclosed room or space passes through conditioned space, the duct shall be insulated to an *R*-value of not less than R-16.

EXCEPTION: Fireplaces and stoves complying with Sections 901 through 905 of the *International Mechanical Code*, and Section 2111.13 of the *International Building Code*.

C402.5.6 Doors and access openings to shafts, chutes, stairways, and elevator lobbies. Doors and access openings from conditioned space to shafts, chutes, stairways and elevator lobbies shall be gasketed, weatherstripped or sealed.

EXCEPTIONS:

1. Door openings required to comply with Section 716 of the *International Building Code*.
2. Doors and door openings required to comply with UL 1784 by the *International Building Code*.

C402.5.7 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures, elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section C403.7.8.

C402.5.8 Loading dock weatherseals. Cargo door openings and loading dock door openings shall be equipped with weatherseals that restrict infiltration and provide direct contact along the top and sides of vehicles that are parked in the doorway.

C402.5.9 Vestibules. All building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors. For the purposes of this section, "building entrances" shall include exit-only doors in buildings where separate doors for entering and exiting are provided.

Interior and exterior doors shall have a minimum distance between them of not less than 7 feet. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. Either the interior or exterior envelope of unconditioned vestibules shall comply with the requirements for a conditioned space. The building lobby is not considered a vestibule.

EXCEPTION: Vestibules are not required for the following:

1. Doors not intended to be used as building entrances.
2. Unfinished ground-level space greater than 3,000 square feet (298 m^2) if a note is included on the permit documents at each exterior entrance to the space stating "Vestibule required at time of tenant build-out if entrance serves a space greater than 3,000 square feet in area."
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors between an enclosed space smaller than 3,000 square feet (298 m^2) in area and the exterior of the building or the building entrance lobby, where those doors do not comprise one of the primary building entrance paths to the remainder of the building. The space must be enclosed and separated without transfer air paths from the primary building entrance paths. If there are doors between the space and the primary entrance path, then the doors shall be equipped with self-closing devices so the space acts as a vestibule for the primary building entrance.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. In buildings less than 3 stories above grade or in spaces that do not directly connect with the building elevator lobby, doors that have an air curtain with a velocity of not less than 6.56 feet per second (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.
8. Building entrances in buildings that are less than four stories above grade and less than 10,000 ft^2 in area.
9. Elevator doors in parking garages provided that the elevators have an enclosed lobby at each level of the garage.
10. Entrances to semi-heated spaces.
11. Doors that are used only to access outdoor seating areas that are separated from adjacent walking areas by a fence or other barrier.

SDCI Informative Note: *Building entrance* is defined as the means ordinarily used to gain access to the building. Doors other than *building entrances*, such as those leading to service areas, mechanical rooms, electrical equipment rooms, outdoor seating areas or exits from fire stairways, are not covered by this requirement. There is less traffic through these doors, and the vestibule may limit access for large equipment. Note that enclosed lobbies in parking garages also serve to reduce the flow of vehicle exhaust into the building.

C402.5.10 Recessed lighting. Recessed luminaires installed in the *building thermal envelope* shall be all of the following:

1. IC rated.
2. *Labeled* as having an air leakage rate of not more than 2.0 cfm (0.944 L/s) when tested in accordance with ASTM E 283 at a 1.57 psf (75 Pa) pressure differential.
3. Sealed with a gasket or caulk between the housing and interior wall or ceiling covering.

C402.5.11 Operable openings interlocking. Where any operable openings to the outdoors are larger than 48 square feet (4.47 m^2) in area, such openings shall be interlocked with the heating and cooling system as required by Section C403.4.1.6.

EXCEPTIONS:

1. Separately zoned areas associated with the preparation of food that contain appliances that contribute to the HVAC loads of a restaurant or similar type of occupancy.
2. Warehouses that utilize overhead doors for the function of the occupancy, where *approved* by the *code official*.
3. The outer entrance doors where located in the exterior wall and are part of a vestibule system.
4. Alterations to existing buildings.

SECTION C403
MECHANICAL SYSTEMS

C403.1 General. Mechanical systems and equipment serving heating, cooling, ventilating, and other needs shall comply with this section.

EXCEPTIONS:

1. Energy using equipment used by a manufacturing, industrial or commercial process other than for conditioning spaces or maintaining comfort and amenities for the occupants are exempt from all Section C403 subsections except for Section C403.3.2, Tables C403.3.2 (1) through (16) inclusive, Sections C403.3.4.1, C403.3.4.2, C403.3.4.3, C403.7.7, C403.9.2.1, C403.10.3, C403.11.2, and C403.11.3, as applicable. Data center and *computer room* HVAC equipment is not covered by this exception.
2. *Data center systems* are exempt from Sections C403.4 and C403.5, but shall comply with ASHRAE 90.4 Sections 6 and 8 according to Section C403.1.3.

C403.1.1 HVAC total system performance ratio (HVAC TSPR). For systems serving ((~~office (including medical office), retail, library, and education occupancies and buildings, which are subject to the requirements of Section C403.3.5 without exceptions, and the dwelling units and residential common areas within Group R-2 multi-family buildings~~)) occupancy areas included in Table C403.1.1, the *HVAC total system performance ratio* (*HVAC TSPR*) of the *proposed design* HVAC system shall be greater than or equal to the *HVAC TSPR* of the *standard reference design* as calculated according to Appendix D, Calculation of HVAC Total System Performance Ratio.

Table C403.1.1
Occupancy Classifications Requiring TSPR

Occupancy Classification	Inclusions	Excluded
A	Library	All other Group A uses
B	Office, medical office	All other Group B uses
E	All occupancies included	
M	All occupancies included	
R	Dwelling units and associated common areas in Group R-2 areas of buildings	Groups R-1 and R-3 occupancies. Sleeping units and associated common areas in Group R-2 areas of buildings
F, H, I, S, U		All occupancies

EXCEPTIONS TO SECTION C403.1.1:

1. Buildings in which the sum of the *conditioned floor area* of ((~~office (including medical office), retail, education, library and multifamily spaces~~)) occupancies included in the Inclusions column of Table C403.1.1 is less than 5,000 square feet. Areas that are eligible for any of the exceptions below do not count towards the 5,000 square feet.
2. HVAC systems using district heating water, chilled water or steam.
3. HVAC systems connected to a *low-carbon district energy exchange system*.

4. HVAC systems not included in Table D601.10.1.
5. HVAC systems with chilled water supplied by absorption chillers, heat recovery chillers, water to water heat pumps, air to water heat pumps, or a combination of air and water cooled chillers on the same chilled water loop.
6. HVAC systems included in Table D601.10.1 with parameters in Table D601.10.2 not identified as applicable to that HVAC system type.
7. HVAC systems served by heating water plants that include air to water or water to water heat pumps.
8. Underfloor air distribution and displacement ventilation HVAC systems.
9. Space conditioning systems that do not include *mechanical cooling*.
10. Alterations to existing buildings that do not substantially replace the entire HVAC system and are not serving initial build-out construction.
11. HVAC systems meeting all the requirements of the *standard reference design* HVAC system in Table D602.11, Standard Reference Design HVAC Systems.
12. Buildings or areas of medical office buildings that comply fully with ASHRAE Standard 170 including, but not limited to, surgical centers, or that are required by other applicable codes or standards to provide 24/7 air handling unit operation.
13. HVAC systems serving the following areas and spaces:
    - 13.1. Laundry rooms.
    - 13.2. Elevator machine rooms.
    - 13.3. Mechanical and electrical rooms.
    - 13.4. Data centers and computer rooms.
    - 13.5. Laboratories with fume hoods.
    - 13.6. Locker rooms with more than two showers.
    - 13.7. Natatoriums and rooms with saunas.
    - 13.8. Restaurants and commercial kitchens with total cooking capacity greater than 100,000 Btu/h.
    - 13.9. Areas of buildings with commercial refrigeration equipment exceeding 100 kW of power input.
    - 13.10. Cafeterias and dining rooms.

SDCI Informative Note: For more information regarding TSPR, see SDCI Tip 425 (Seattle SDCI Tip 425—HVAC Total System Performance Ratio) and the free online calculation tools developed by PNNL for this use linked on Page 2 of the Tip.

C403.1.2 Calculation of heating and cooling loads. Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with the procedures described in ANSI/ASHRAE/ACCA Standard 183 or by an *approved* equivalent computational procedure, using the design parameters specified in Chapter 3. Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE *HVAC Systems and Equipment Handbook* by an *approved* equivalent computational procedure.

C403.1.3 Data centers. *Data center systems* shall comply with this code and with Sections 6 and 8 of ASHRAE Standard 90.4.

SDCI Informative Note: The ASHRAE Standard 90.4 reference in Chapter 6 has been updated to the 2022 edition.

C403.1.4 Use of electric resistance and fossil fuel-fired HVAC heating equipment. HVAC heating energy shall not be provided by electric resistance or fossil fuel combustion appliances. For the purposes of this section, electric resistance HVAC heating appliances include, but are not limited to, electric baseboard, electric resistance fan coil and VAV electric resistance terminal reheat units and electric resistance boilers. For the purposes of this section, fossil fuel combustion HVAC heating appliances include, but are not limited to, appliances burning natural gas, heating oil, propane, or other fossil fuels.

EXCEPTIONS:

1. Low heating capacity. Buildings or areas of buildings, other than *dwelling units* or sleeping units, that meet the interior temperature requirements of Chapter 12 of the *International Building Code* with a total installed HVAC heating capacity no greater than 8.5 Btu/h (2.5 watts) per square foot of *conditioned space* are permitted to be heated using electric resistance appliances.

2. Dwelling and sleeping units. Dwelling or sleeping units are permitted to be heated using electric resistance appliances as long as the installed HVAC heating capacity in any separate space is not greater than ((÷)) specified in 2.1 through 2.3. Where a single dwelling unit includes multiple habitable spaces that are all heated with electric resistance heat, individual spaces are permitted to have more electric resistance heating capacity than specified in 2.1 through 2.3, where the total electric resistance heating capacity for the dwelling unit is less than or equal to the total allowed.

SDCI Informative Note for exception 2: As an example, a one-bedroom apartment could, instead of placing 750 watts of heating in the living room and another 750 watts in the bedroom (1,500 watt total), place 1,000 watts in the living room and 500 watts in the bedroom, for the same 1,500 watt total.

2.1. Seven hundred fifty (750) watts in Climate Zone 4, ((~~and 1000 watts in Climate Zone 5~~)) in each habitable space with exterior fenestration.

2.2. One thousand (1000) watts in Climate Zone 4, ((~~and 1300 watts in Climate Zone 5~~)) for each habitable space that has two primary walls facing different cardinal directions, each with exterior fenestration. Bay windows and other minor offsets are not considered primary walls.

2.3. Two hundred fifty (250) watts in spaces adjoining the *building thermal envelope* but without exterior fenestration.

For the purposes of this section, habitable space is as defined in the International Building Code. ((~~For buildings in locations with exterior design conditions below 4°F (-16°C), an additional 250 watts above that allowed for Climate Zone 5 is permitted in each space with fenestration.~~))

3. Small buildings. Buildings with less than 2,500 square feet (232 m^2) of *conditioned floor area* are permitted to be heated using electric resistance appliances.

4. Defrost. Heat pumps are permitted to utilize electric resistance heating when a heat pump defrost cycle is required and is in operation.

5. Air-to-air heat pumps. Buildings are permitted to utilize electric resistance supplemental heating for air-to-air heat pumps that meet all of the following conditions:

5.1. Internal electric resistance heaters have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery.

5.2. The heat pump controls are configured to use the compressor as the first stage of heating down to an outdoor air temperature of 17°F (-8°C) or lower except when in defrost.

EXCEPTIONS TO 5.2:

1. Packaged terminal heat pumps (PTHPs) that comply with the minimum heating efficiency requirements in Table C403.3.2(4) are exempt from heating pump controls capable of operating the compressor as the first stage of heating down to an outdoor air temperature of 17°F (-8°C) or lower.
2. Heat pumps whose minimum efficiency is regulated by NAECA and whose ratings meet the requirements shown in Table C403.3.2(2) and include all usage of internal electric resistance heating are exempt from heat pump controls capable of operating the compressor as the first state of heating down to an outdoor air temperature of 17°F (-8°C) or lower.

5.3. The heat pump complies with one of the following:

5.3.1. Controlled by a digital or electronic thermostat designed for heat pump use that energizes the supplemental heat only when the heat pump has insufficient capacity to maintain set point or to warm up the space at a sufficient rate.

5.3.2. Controlled by a multistage space thermostat and an outdoor air thermostat wired to energize supplemental heat only on the last stage of the space thermostat and when outdoor air temperature is less than 32°F (0°C) except when in defrost.

5.3.3. The minimum efficiency of the heat pump is regulated by NAECA, its rating meets the requirements shown in Table C403.3.2(2), and its rating includes all usage of internal electric resistance heating.

5.4. The heat pump rated heating capacity is sized to meet the heating load at an outdoor air temperature of 32°F (0°C) or lower and has a rated heating capacity at 47°F (8°C) no less than 2 times greater than supplemental heating capacity in Climate Zone 4 and no less than the supplemental heating capacity in Climate Zone 5, or utilizes the smallest available factory-available internal electric resistance heater.

6. Air-to-water heat pumps. Buildings are permitted to utilize electric resistance (((~~for Climate Zone 4 or 5) or fossil fuel-fired (for Climate Zone 5)~~))) auxiliary heating to supplement heat pump heating for hydronic heating systems that meet all of the following conditions:
    6.1. Controls for the auxiliary heating sources are configured to lock out the supplemental heat when the outside air temperature is above 36°F (2°C), unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
    6.2. The heat pump controls are configured to use the compressor as the first stage of heating down to the lowest exterior design temperature for which the equipment is rated except during startup or defrost operation.
    6.3. The heat pump rated heating capacity at 47°F (8°C) is no less than 75 percent of the design heating load at 29°F (-2°C).
7. Ground source heat pumps. Buildings are permitted to utilize electric resistance supplemental heating for hydronic heating systems with ground source heat pump equipment that meets all of the following conditions:
    7.1. Controls for the auxiliary heating sources are configured to lock out the supplemental heat when the equipment source-side entering water temperature is above 42°F (6°C), unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
    7.2. The heat pump controls are configured to use the compressor as the first stage of heating.
    7.3. The ground source heat exchanger shall be sized so that the heat pump annual heating output is no less than 70 percent of the total annual heating output in the final year of a 30-year simulation using IGSHPA listed simulation software.
8. Small systems. Buildings in which electric resistance or fossil fuel appliances, including decorative appliances, either provide less than 5 percent of the total building HVAC system heating capacity or serve less than 5 percent of the *conditioned floor area*.
9. Specific conditions. Portions of buildings that require fossil fuel or electric resistance space heating for specific conditions *approved* by the *code official* for research, health care, process or other specific needs that cannot practicably be served by heat pump or other space heating systems. This does not constitute a blanket exception for any occupancy type.
10. Kitchen make-up air. Make-up air for commercial kitchen exhaust systems required to be tempered by Section 508.1.1 of the *International Mechanical Code* is permitted to be heated by using fossil fuel in Climate Zone 5 or electric resistance in Climate Zone 4 or 5.
11. District energy. Steam or hot water district energy systems that utilize fossil fuels as their primary source of heat energy, that serve multiple buildings, and that were already in existence prior to the effective date of this code, including more energy-efficient upgrades to such existing systems, are permitted to serve as the primary heating energy source.
12. Heat tape. Heat tape is permitted where it protects water-filled equipment and piping located outside of the *building thermal envelope*, provided that it is configured and controlled to be automatically turned off when the outside air temperature is above 40°F (4°C).
13. Temporary systems. Temporary electric resistance heating systems are permitted where serving future tenant spaces that are unfinished and unoccupied, provided that the heating equipment is sized and controlled to achieve interior space temperatures no higher than 40°F (4°C).
14. Pasteurization. Electric resistance heat controls are permitted to reset the supply water temperature of hydronic heating systems that serve service water heating heat exchangers during pasteurization cycles of the service hot water storage volume. The hydronic heating system supply water temperature shall be configured to be 145°F (63°C) or lower during the pasteurization cycle.
15. Freeze protection. Heating systems sized for spaces with indoor design conditions of 45°F (7°C) and intended for freeze protection are permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.
16. DOAS ERV auxiliary heat. Dedicated outdoor air systems with energy recovery ventilation are permitted to utilize ((~~fossil fuel for Climate Zone 5 or~~)) electric resistance ((~~in Climate Zone 4 or 5~~)) for auxiliary heating to preheat outdoor air for defrost or as auxiliary supplemental heat to temper supply air to 55°F (13°C) or lower for buildings or portions of buildings that do not have hydronic heating systems.
17. Low-carbon district energy systems. Low-carbon district energy systems that meet the definitions of *low-carbon district energy exchange system* or *low-carbon district heating and cooling or heating only systems*.
18. Essential facilities. Groups I-2 and I-3 occupancies that by regulation are required to have in place redundant emergency backup systems, and research laboratories, are permitted to use fossil fuels for emergency generators

and for redundant emergency space heating and water heating appliances, provided that such systems are sized and controlled to operate only upon loss of electrical power.

19. Standby HVAC heating equipment. Standby HVAC heating equipment provided in addition to the primary heating system, and controlled such that it will only be used when the primary heating equipment is not available, is permitted to be electric resistance.
20. Emergency generators. Generators serving emergency power, legally required standby power, or optional standby power are permitted to use fossil fuels.
21. Wastewater heat recovery heat pumps. Buildings are permitted to utilize electric resistance auxiliary heating to supplement heat pump heating for hydronic heating systems with wastewater heat recovery or other approved waste heat recovery systems provided the heat pump equipment that meets all of the following conditions:
    - 21.1. Controls for the auxiliary resistance heating are configured to lock out the supplemental heat when the equipment source-side entering water temperature is above 42°F, unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
    - 21.2. The heat pump controls are configured to use the compressor as the first stage of heating.
    - 21.3. The wastewater heat exchanger and heat pumps or other heat pump supplemental systems shall be sized so that the heat pump rated heating capacity at heat pump design entering water temperature conditions or other heat pump heating systems are no less than 75 percent of the design heating load at 29°F. Wastewater heat exchanger source side shall be sized for a design wastewater entering temperature of 55°F or lower.
22. Mechanical systems located outside of the building thermal envelope. Mechanical systems providing heat outside of the thermal envelope that comply with Section C403.11 are permitted to utilize electric resistance appliances. Snow- and ice-melt systems that comply with Section C403.11.2 are permitted to utilize electric resistance heat to back up the primary electric heat pump heating system in accordance with Exceptions 6 and 7 of Section C403.1.4.

C403.2 System design. Mechanical systems shall be designed to comply with Sections C403.2.1 and C403.2.4. Where elements of a building's mechanical systems are addressed in Sections C403.3 through C403.13, such elements shall comply with the applicable provisions of those sections.

C403.2.1 Zone isolation required. HVAC systems, DOAS and exhaust systems serving areas that are intended to operate or be occupied nonsimultaneously shall be divided into separate isolation areas. Zones intended to be occupied simultaneously may be grouped into a single isolation area provided the combined total area does not exceed 25,000 square feet (2323 m^2) of conditioned floor area and does not include more than one floor. Each isolation area shall be equipped with isolation devices and controls configured to automatically shut off the supply of conditioned air and outdoor air to and exhaust air from the isolation area. Each isolation area shall be controlled independently by a device meeting the requirements of Section C403.4.2.2. Central systems and plants shall be provided with controls and devices that will allow system and equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

EXCEPTIONS:

1. Exhaust air and outdoor air connections to isolation areas where the fan system to which they connect is not greater than 5,000 cfm (2360 L/s).
2. Exhaust airflow from a single isolation area of less than 10 percent of the design airflow of the exhaust system to which it connects.
3. Isolation areas intended to operate continuously or intended to be inoperative only when all other isolation areas in a *zone* are inoperative.

C403.2.2 Ventilation and exhaust.

C403.2.2.1 Ventilation. Ventilation, either natural or mechanical, shall be provided in accordance with Chapter 4 of the *International Mechanical Code*. Where mechanical ventilation is provided, the system shall be configured to provide no greater than 150 percent of the minimum outdoor air required by Chapter 4 of the *International Mechanical Code* or other applicable code or standard, whichever is greater.

EXCEPTIONS:

1. The mechanical system may supply outdoor air at rates higher than the limit above when it is used for particulate or VOC dilution, economizing or night flushing, dehumidification, pressurization, exhaust make-up, or other process air delivery. Outdoor air shall be reduced to the minimum ventilation rates when not required for the preceding uses.
2. Air systems supplying dwelling or sleeping units within Group R-1, R-2 or I-2 occupancies.
3. Alterations that replace less than half of the total heating and cooling capacity of the system.

EXCEPTIONS:

1. Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
2. Multiple units of the same equipment type with combined capacities exceeding the design load and provided with controls that are configured to sequence the operation of each unit based on load.

C403.3.2 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2 (16) when tested and rated in accordance with the applicable test procedure. After new equipment efficiency values including HSPF2, EER2, and SEER2 have been published by the US Department of Energy, equipment is permitted to meet those values in lieu of the table values. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. The efficiency shall be verified through certification and listed under an *approved* certification program or, if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

Air-to-water heat pump manufacturers shall report the hourly heating output or heating efficiency with and without defrost operation at 32°F, in addition to meeting the efficiency requirements of Table C403.3.2(15) at the AHRI 550/590 applicable leaving water temperatures. The hourly heating output or heating efficiency with and without defrost operation shall be documented on the mechanical permit application documents.

EXCEPTION: Heat recovery chillers and air-to-water heat pumps covered under Table C403.3.2(15), are not required to be listed in the AHRI certification program for AHRI 550/590. The equipment heating and cooling efficiency ratings shall be supported by data furnished by the manufacturer at AHRI 550/590 conditions. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements.

SDCI Informative Note: Table C403.3.2.(13) is from ASHRAE 90.1-2019. At the time of the adoption of the 2021 SEC it was not clear whether any air-to-water heat pumps or heat recovery chillers would be listed in the AHRI Certified Product Directory. https://www.ahridirectory.org/ According to AHRI 550/590 Section 5.3, "Full and part-load application ratings shall include the range of Rating Conditions listed in Table 2 or be within the operating limits of the equipment."

C403.3.2.1 Gas-fired and oil-fired forced air furnaces. Forced air furnaces with input ratings ≥ 225,000 Btu/h (65 kW) and all unit heaters shall also have an intermittent ignition or interrupted device (IID), and have either mechanical draft (including power venting) or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings ≥ 225,000 Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.

SDCI Informative Note: Fossil fuel-fired heating equipment is generally prohibited by Section C403.1.4.

C403.3.2.2 Hydronic and multiple-zone HVAC system controls and equipment. Hydronic and multiple-zone HVAC system controls and equipment shall comply with this section.

For buildings with a total equipment cooling capacity of 300 tons and above, the equipment shall comply with one of the following:

1. No one unit shall have a cooling capacity of more than 2/3 of the total installed cooling equipment capacity;
2. The equipment shall have a variable speed drive; or
3. The equipment shall have multiple compressors.

C403.3.2.3 Chillers. Chilled water plants and buildings with more than 500 tons total cooling capacity shall not have more than 100 tons provided by air-cooled chillers.

EXCEPTIONS:

1. Where the designer demonstrates that the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled equipment.
2. Air-cooled chillers with minimum efficiencies at least 10 percent higher than those listed in Table C403.3.2(3).
3. Replacement of existing air-cooled chiller equipment.
4. Air-to-water heat pump units that are configured to provide both heating and cooling and that are rated in accordance with AHRI 550/590.

Table C403.3.4.3
Boiler Stack-Gas Oxygen Concentrations

Boiler System Type	Maximum Stack-Gas Oxygen Concentration[a]
Less than 10% of the boiler system capacity is used for process applications at design conditions	5%
All others	3%

a Concentration levels measured by volume on a dry basis over firing rates of 20 to 100 percent.

C403.3.4.4 Boiler turndown. *Boiler systems* with design input of greater than 1,000,000 Btu/h (293 kW) shall comply with the turndown ratio specified in Table C403.3.4.4.

The system turndown requirement shall be met through the use of multiple single input boilers, one or more *modulating boilers* or a combination of single input and modulating boilers.

Table C403.3.4.4
Boiler Turndown

Boiler System Design Input (Btu/h)	Minimum Turndown Ratio
≥ 1,000,000 and less than or equal to 5,000,000	3 to 1
≥ 5,000,000 and less than or equal to 10,000,000	4 to 1
≥ 10,000,000	5 to 1

C403.3.4.5 Buildings with high-capacity space-heating gas boiler systems. New buildings with gas hot water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h but not more than 10,000,000 Btu/h shall comply with this section.

EXCEPTIONS:

1. Where 25 percent of the annual space heating requirement is provided by site-recovered energy, or heat recovery chillers.
2. Space heating boilers installed in individual dwelling units.
3. Where 50 percent or more of the design heat load is served using perimeter convective heating, radiant ceiling panels, or both.
4. Individual gas boilers with input capacity less than 300,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

C403.3.4.5.1 Boiler efficiency. Gas hot water boilers shall have a minimum thermal efficiency (Et) of 90 percent when rated in accordance with the test procedures in Table C403.3.2(6). Systems with multiple boilers are allowed to meet this requirement if the space-heating input provided by equipment with thermal efficiency (Et) above and below 90 percent provides an input capacity-weighted average thermal efficiency of at least 90 percent. For boilers rated only for combustion efficiency, the calculation for the input capacity-weighted average thermal efficiency shall use the combustion efficiency value.

C403.3.4.5.2 Hot water distribution system design. The hot water distribution system shall be designed to meet all of the following:

1. Coils and other heat exchangers shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F (48.9°C) or less.
2. Under all operating conditions, the water temperature entering the boiler is 120°F (48.9°C) or less, or the flow rate of supply hot water that recirculates directly into the return system, such as three-way valves or minimum flow bypass controls, shall be no greater than 20 percent of the design flow of the operating boilers.

C403.3.5 Dedicated outdoor air systems (DOAS). For buildings with occupancies as shown in Table C403.3.5, outdoor air shall be provided to each occupied space by a dedicated outdoor air system (DOAS) which delivers 100 percent outdoor air without requiring operation of the heating and cooling system fans for ventilation air delivery.

EXCEPTIONS:

1. Occupied spaces that are not ventilated by a mechanical ventilation system and are only ventilated by a natural ventilation system in accordance with Section 402 of the *International Mechanical Code*.
2. High efficiency variable air volume (VAV) systems complying with Section C403.6.10 for occupancy classifications other than Groups A-1, A-2 and A-3 as specified in Table C403.3.5, and high efficiency VAV systems complying with Section C403.12 for occupancy classification Groups A-1, A-2 and A-3 as specified in Table C403.3.5. This exception shall not be used as a substitution for a DOAS per Section C406.6.

3. Spaces that are within building types not subject to the requirements of Section C403.3.5, and that qualify as accessory occupancies according to Section 508.2 of the International Building Code, are not required to comply with this section.

Table C403.3.5
Occupancy Classifications Requiring DOAS

Occupancy Classification[a]	Inclusions	Exempted
A-1	All occupancies not specifically exempted	Television and radio studios
A-2	Casinos (gaming area)	All other A-2 occupancies
A-3	Lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, places of religious worship	All other A-3 occupancies
A-4, A-5		All occupancies excluded
B	All occupancies not specifically exempted	Food processing establishments including commercial kitchens, restaurants, cafeterias; laboratories for testing and research; data processing facilities and telephone exchanges; air traffic control towers; animal hospitals, kennels, pounds; ambulatory care facilities
F, H, I, R, S, U		All occupancies excluded
E, M	All occupancies included	

a. Occupancy classification from the *International Building Code* Chapter 3.

C403.3.5.1 DOAS with energy recovery ventilation. The DOAS shall include energy recovery. The *energy recovery ventilation* system shall have a ((~~68~~)) 67 percent minimum sensible recovery effectiveness of the energy recovery device as calculated in accordance with Equation 4-9 or provide an enthalpy recovery ratio of not less than 60 percent at design conditions in accordance with Section C403.7.6. The airflow rate thresholds in Section C403.7.6 that define when the energy recovery requirements in that section do not apply, are not applicable to this section. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C) at 30 percent relative humidity, or as calculated by the registered design professional.

$$\text{Sensible Recovery Effectiveness} = \frac{T_{OA} - T_{SA}}{T_{OA} - T_{RA}} \qquad \textbf{(Equation 4-9)}$$

Where:

T_{OA} = Design outdoor air dry bulb temperature entering the energy recovery device.

T_{SA} = Supply air dry bulb temperature leaving the energy recovery device at design temperatures and airflow conditions, as selected for the proposed DOAS unit(s).

T_{RA} = Design return air dry bulb temperature.

EXCEPTIONS:

1. Systems installed for the sole purpose of providing makeup air for systems exhausting toxic, flammable, paint, or corrosive fumes or dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.
2. Heat recovery and energy recovery ventilators (H/ERV) that are rated and *listed* in accordance with HVI 920 can demonstrate compliance with the sensible recovery effectiveness requirement using the adjusted sensible recovery effectiveness (ASRE) rating of the equipment at 32°F test conditions. Applied flow rate for ASRE rating shall be no less than the design flow rate or the closest value interpolated between two listed flow rates.

((~~3. The energy recovery systems for Group R-2 occupancies are permitted to provide 50 percent minimum sensible heat recovery effectiveness in lieu of 68 percent sensible recovery effectiveness in accordance with Section C403.7.6. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C) or as determined by an *approved* calculation procedure.~~))

C403.3.5.2 DOAS fan power. For a DOAS that does not have at least one fan or fan array with fan electrical input power ≥ 1 kW, the total combined fan power shall not exceed ((~~1 watt~~)) 0.8 watts per cfm of outdoor air as calculated in accordance with Equation 4-10 using design maximum airflows and external static pressures. For a DOAS with at least one fan or fan array with fan electrical input power ≤ 1 kW, the DOAS shall comply with the fan power limitations of Section C403.8.1. DOAS total combined fan power shall include all supply, exhaust and other fans utilized for the

purpose of ventilation. This fan power restriction applies to each DOAS in the permitted project, but does not include the fan power associated with the zonal heating and cooling equipment.

DOAS Total Combined Fan Power $\left(\frac{Watts}{CFM}\right) = \sum\left(\frac{Fan\ bhp}{\eta_m}\right) \times \frac{746}{CFM_{supply}}$ **(Equation 4-10)**

Where:

Fan bhp = Brake horsepower for each supply, exhaust and other fan in the system at design maximum airflow rate.

η_m = Fan motor efficiency including all motor, drive and other losses for each fan in the system.

CFM_{supply} = Design maximum airflow rate of outdoor (supply) air.

C403.3.5.3 Heating and cooling system fan controls. Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the *zone*.

EXCEPTION: Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures are within the setpoint deadband (Section C403.4.1.2) to provide destratification and air mixing in the space.

C403.3.5.4 Decoupled DOAS supply air. The DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating and/or cooling coils.

EXCEPTIONS:

1. Active chilled beam systems.
2. Sensible only cooling terminal units with pressure independent variable airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.
3. Terminal heating and/or cooling units that comply with the low fan power allowance requirements in the exception of Section C403.3.5.3.

C403.3.5.5 Supplemental heating and cooling. Supply air stream heating in the DOAS system shall comply with Section C403.7.3. Cooling is permitted for dehumidification only. Cooling coil shall be sized to meet peak dehumidification requirement at design outdoor temperatures, and no larger. Cooling coil shall be controlled to maintain supply air relative humidity or *zone* relative humidity.

EXCEPTIONS:

1. Heating permitted for defrost control shall be locked out when outside air temperatures are above 35°F (2°C). Supplemental heating for defrost shall modulate to 10 percent of the peak capacity, and shall be sized to prevent ((~~frost/damage dame~~)) frost damage to the unit at design temperatures and provide supply air less than or equal to 55°F (13°C).
2. A DOAS serving Group R-1 or R-2 occupancy spaces that are served by zonal heating systems, but not by zonal heat pumps, air conditioners, or other zonal mechanical cooling systems, is permitted to be provided with a supplemental heating and cooling system in compliance with Section C403.1.4.

C403.3.5.6 Impracticality. Where the *code official* determines that full compliance with one or more of the requirements in Sections C403.3.5.1 through C403.3.5.5 is impractical, it is permissible to provide an approved alternate means of compliance that achieves a comparable level of energy efficiency as the requirement(s) deemed impractical. For the purposes of this section, impractical means that an HVAC system complying with all requirements in Section C403.3.5 cannot effectively be utilized due to an unusual use or configuration of the building.

C403.3.6 (Reserved) ((~~Ventilation for Group R-2 occupancy.~~ ~~For all Group R-2 dwelling and sleeping units, a balanced ventilation system with a heat recovery system shall provide outdoor air directly to all habitable spaces. The heat recovery system shall have a 60 percent minimum sensible recovery effectiveness as calculated in accordance with Section C403.3.5.1. The ventilation system shall allow for the design flow rates to be tested and verified at each habitable space as part of the commissioning process in accordance with Section C408.2.2.~~

~~**EXCEPTION:**~~ ~~Heat recovery and energy recovery ventilators (H/ERV) that are rated and listed in accordance with HVI 920 can demonstrate compliance with the sensible recovery effectiveness requirement using the adjusted sensible recovery effectiveness (ASRE) rating of the equipment at 32°F test conditions. Applied flow rate for ASRE rating shall be no less than the design flow rate or the closest value interpolated between two listed flow rates.~~))

SDCI Informative Note: See Section C403.7.6.1 for Ventilation for Group R-2 occupancies.

C403.3.7 Hydronic system flow rate. Chilled water and condenser water piping shall be designed such that the design flow rate in each pipe segment shall not exceed the values listed in Table C403.3.7 for the appropriate total annual hours of operation. Pipe sizes for systems that operate under variable flow conditions (e.g., modulating 2-way control valves at coils) and that contain variable speed pump motors are permitted to be selected from the "Variable Flow/Variable Speed" columns. All others shall be selected from the "Other" columns.

EXCEPTION: Design flow rates exceeding the values in Table C403.3.7 are permitted in specific sections of pipe if the pipe is not in the critical circuit at design conditions and is not predicted to be in the critical circuit during more than 30 percent of operating hours.

SDCI Informative Note: The flow rates listed here do not consider noise or erosion. Lower flow rates are often recommended for noise sensitive locations.

Table C403.3.7
Piping System Design Maximum Flow Rate in GPM[a]

Pipe Size	≤ 2000 hours/year		> 2000 and ≤ 4400 hours/year		> 4400 hours/year	
(in)	Other	Variable Flow/ Variable Speed	Other	Variable Flow/ Variable Speed	Other	Variable Flow/ Variable Speed
2-1/2	120	180	85	130	68	110
3	180	270	140	210	110	170
4	350	530	260	400	210	320
5	410	620	310	470	250	370
6	740	1100	570	860	440	680
8	1200	1800	900	1400	700	1100
10	1800	2700	1300	2000	1000	1600
12	2500	3800	1900	2900	1500	2300
Maximum velocity for pipes over 14 to 24 in. in size	8.5 ft/s	13.0 ft/s	6.5 ft/s	9.5 ft/s	5.0 ft/s	7.5 ft/s

a There are no requirements for pipe sizes smaller than the minimum size or larger than the maximum size shown in the table.

C403.3.8 Hydronic coil selection. Hydronic coils shall comply with Sections C403.3.8.1 and C403.3.8.2.

EXCEPTION: Replacement coils within existing equipment.

C403.3.8.1 Chilled-water coil selection. Chilled-water cooling coils shall be selected to provide a 15°F or higher temperature difference between leaving and entering water temperatures and a minimum of 57°F leaving water temperature at design conditions.

EXCEPTIONS:

1. Chilled-water cooling coils that have an airside pressure drop exceeding 0.70 in. of water when rated at 500 fpm face velocity and dry conditions (no condensation).
2. Individual fan-cooling units with a design supply airflow rate ≤ 5000 cfm.
3. Constant-air-volume systems.
4. Coils selected at the maximum temperature difference allowed by the cooling plant equipment manufacturer's approved operating conditions.
5. Passive coils (no mechanically supplied airflow).
6. Coils with design entering chilled-water temperature ≥ 50°F (10°C).
7. Coils with design entering air dry-bulb temperature ≤ 65°F (18°C).

C403.3.8.2 Hot-water coil selection. Hot-water heating coils shall be selected to provide a maximum 20°F temperature difference between leaving and entering water temperatures and a maximum of 118°F (48°C) entering water temperature at design conditions.

EXCEPTIONS:

1. Hot-water heating systems which utilize heat pumps as the primary source.
2. Individual terminal fan units with a design supply airflow rate ≤ 1500 cfm are exempt from the 20°F maximum temperature difference between leaving and entering water temperature requirement.
3. Passive coils (no mechanically supplied airflow).
4. Coils with design leaving air temperature ≥ 95°F (35°C).

C403.4 HVAC system controls. HVAC systems shall be provided with controls in accordance with Sections C403.4.1 through C403.4.12 and shall be capable of and configured to implement all required control functions in this code.

C403.4.1 Thermostatic controls. The supply of heating and cooling energy to each *zone* shall be controlled by individual thermostatic controls capable of responding to temperature within the *zone*. Controls in the same zone or in neighboring zones connected by openings larger than 10 percent of the floor area of either zone shall not allow for simultaneous heating and cooling. At a minimum, each floor of a building shall be considered as a separate zone. Controls on systems required to have economizers and serving single zones shall have multiple cooling stage capability and activate the economizer when appropriate as the first stage of cooling. See Section C403.5 for further economizer requirements. Where humidification or dehumidification or both is provided, at least one humidity control device shall be provided for each humidity control system.

EXCEPTIONS:

1. Independent perimeter systems that are designed to offset only building envelope heat losses or gains or both serving one or more perimeter *zones* also served by an interior system provided:
   1.1. The perimeter system includes at least one thermostatic control *zone* for each building exposure having exterior walls facing only one orientation (within +/-45 degrees) (0.8 rad) for more than 50 contiguous feet (15,240 mm);
   1.2. The perimeter system heating and cooling supply is controlled by a thermostat located within the *zones* served by the system; and
   1.3. Controls are configured to prevent the perimeter system from operating in a different heating or cooling mode from the other equipment within the zones or from neighboring zones connected by openings larger than 10 percent of the floor area of either zone.
2. Where an interior zone and a perimeter zone are open to each other with permanent openings larger than 10 percent of the floor area of either zone, cooling in the interior zone is permitted to operate at times when the perimeter zone is in heating and the interior zone temperature is at least 5°F (2.8°C) higher than the perimeter zone temperature. For the purposes of this exception, a permanent opening is an opening without doors or other operable closures.
3. Dedicated outdoor air units that provide ventilation air, make-up air or replacement air for exhaust systems are permitted to be controlled based on supply air temperature. The supply air temperature shall be controlled to a maximum of 65°F (18.3°C) in heating and a minimum of 72°F (22°C) in cooling unless the supply air temperature is being reset based on the status of cooling or heating in the zones served or it being reset based on outdoor air temperature.

((~~**C403.4.1.1 Heat pump supplementary heat control.** Unitary air-cooled heat pumps shall include microprocessor controls that minimize supplemental heat usage during start-up, set-up, and defrost conditions. These controls shall anticipate need for heat and use compression heating as the first stage of heat. Controls shall indicate when supplemental heating is being used through visual means (e.g., LED indicators). Heat pumps equipped with supplementary heaters shall be installed with controls that prevent supplemental heater operation above 40°F (4.4°C). Heat pumps equipped with internal electric resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Heat pumps equipped with supplemental heaters shall comply with all conditions of Section C403.1.4.~~

~~**EXCEPTIONS:**~~

~~1. Packaged terminal heat pumps (PTHPs) of less than 2 tons (24,000 Btu/hr) cooling capacity that have reverse-cycle demand defrost and are configured to operate in heat pump mode whenever the outdoor air temperatures are above 25°F (-3.9°C) and the unit is not in defrost.~~

~~2. Heat pumps whose minimum efficiency is regulated by NAECA and whose ratings meet the requirements shown in Table C403.3.2(2) and include all usage of internal electric resistance heating.~~))

C403.4.1.1 Heat pump supplementary heat control. Heat pumps equipped with internal electric resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Heat pumps equipped with supplementary heaters shall comply with all conditions of Section C403.1.4,

EXCEPTIONS:

1. Packaged terminal heat pumps (PTHPs) of less than 2 tons (24,000 Btu/hr) cooling capacity that have reverse-cycle demand defrost and are configured to operate in heat pump mode whenever the outdoor air temperatures are above 25°F (-3.9°C) and the unit is not in defrost.

2. Heat pumps whose minimum efficiency is regulated by NAECA and whose ratings meet the requirements shown in Table C403.3.2(2) and include all usage of internal electric resistance heating.

C403.4.1.2 Deadband. Where used to control both heating and cooling, zone thermostatic controls shall be configured to provide a temperature range or deadband of at least 5°F (2.8°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

EXCEPTIONS:

1. Thermostats requiring manual changeover between heating and cooling modes.
2. Occupancies or applications requiring precision in indoor temperature control as *approved* by the *code official*.

C403.4.1.3 Setpoint overlap restriction. Where a *zone* has a separate heating and a separate cooling thermostatic control located within the zone, a limit switch, mechanical stop or direct digital control system with software programming shall be configured to prevent the heating setpoint from exceeding the cooling setpoint and to maintain a deadband in accordance with Section C403.4.1.2.

C403.4.1.4 Heated or cooled vestibules and air curtains. The heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 45°F (7°C). Vestibule heating and cooling systems shall be controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 60°F (16°C) and cooling to a temperature not less than 85°F (29°C).

EXCEPTIONS:

1. Control of heating or cooling provided by transfer air that would otherwise be exhausted.
2. Vestibule heating only systems are permitted to be controlled without an outdoor air temperature lockout when controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 45°F (7°C) where required for freeze protection of piping and sprinkler heads located in the vestibule.

C403.4.1.5 Hot water boiler outdoor temperature setback control. Hot water boilers that supply heat to the building through one- or two-pipe heating systems shall have an outdoor setback control that lowers the boiler water temperature based on the outdoor temperature.

C403.4.1.6 Operable opening switches for HVAC system thermostatic control. Operable openings meeting the minimum size criteria of Section C402.5.11 and that open to the outdoors from a conditioned space must have controls configured to do the following once doors have been open for 5 minutes:

1. Disable the mechanical heating to the zone or reset the space heating temperature setpoint to 55°F or less within 5 minutes of the door open enable signal.
2. Disable the mechanical cooling to the zone or reset the space cooling temperature setpoint to 85°F or more within 5 minutes of the door open enable signal.

EXCEPTION: Hydronic radiant heating and cooling systems.

C403.4.1.7 Demand responsive controls. Thermostatic controls for heating or cooling systems shall be provided with *demand responsive controls* capable of increasing the cooling setpoint and decreasing the heating setpoint by no less than 4°F (2.2°C). The thermostatic controls shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available. Systems with *direct digital control* of individual *zones* report to a central control panel shall be capable of remotely increasing the cooling setpoint and decreasing the heating setpoint for each *zone* by no less than 4°F (2.2°C).

EXCEPTIONS:

1. Health care and assisted living facilities.
2. Group R-2 occupancy dwelling and sleeping units.

C403.4.2 Off-hour controls. For all occupancies other than Group R, and for *conditioned spaces* other than *dwelling units* and *sleeping units* within Group R occupancies, each *zone* shall be provided with thermostatic setback controls that are controlled by either an automatic time clock or programmable control system.

EXCEPTIONS:

1. *Zones* that will be operated continuously.
2. *Zones* with a full HVAC load demand not exceeding 6,800 Btu/h (2 kW) and having a manual shutoff switch located with *ready access*.

solution, i.e. 32°F (0°C) for 100 percent water applications, and 18°F (-7.8°C) for 20 percent by mass propylene glycol solution.

2. Where an open-circuit cooling tower is used directly in the heat pump loop, an *automatic* valve shall be installed to bypass all heat pump water flow around the open-circuit cooling tower.
3. Where an open-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the open-circuit cooling tower from the heat pump loop, heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

EXCEPTION: Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.

C403.4.3.3.3 Isolation valve. Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-way (but not three-way) valve. For the purposes of this section, pump system power is the sum of the nominal power demand (i.e., nameplate horsepower at nominal motor efficiency) of motors of all pumps that are required to operate at design conditions to supply fluid from the heating or cooling source to all heat transfer devices (e.g., coils, heat exchanger) and return it to the source. This converts the system into a variable flow system and, as such, the primary circulation pumps shall comply with the variable flow requirements in Section C403.4.6.

C403.4.4 Part load controls. Hydronic systems greater than or equal to 300,000 Btu/h (88 kW) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that are configured to:

1. Automatically reset the supply-water temperatures in response to varying building heating and cooling demand using coil valve position, zone-return water temperature or outdoor air temperature. The temperature shall be reset by not less than 25 percent of the design supply-to-return water temperature difference.

   EXCEPTIONS:

   1. Hydronic systems serving hydronic heat pumps.
   2. Hydronic systems with thermal energy storage where resetting the supply-water temperature would reduce the capacity of the storage.
2. Automatically vary fluid flow for hydronic systems with a combined pump motor capacity of 2 hp or larger with three or more control valves or other devices by reducing the system design flow rate by not less than 50 percent or the maximum reduction allowed by the equipment manufacturer for proper operation of equipment by valves that modulate or step open and close, or pumps that modulate or turn on and off as a function of load.
3. Automatically vary pump flow on heating water systems, chilled-water systems and heat rejection loops serving water-cooled unitary air conditioners as follows:

   3.1. Where pumps operate continuously or operate based on a time schedule, pumps with nominal output motor power of 2 hp or more shall have a variable speed drive.

   3.2. Where pumps have automatic direct digital control configured to operate pumps only when zone heating or cooling is required, a variable speed drive shall be provided for pumps with motors having the same or greater nominal output power indicated in Table C403.4.4 based on the climate zone and system served.
4. Where variable speed drive is required by Item 3 of this section, pump motor power input shall be not more than 30 percent of design wattage at 50 percent of the design water flow. Pump flow shall be controlled to maintain one control valve nearly wide open or to satisfy the minimum differential pressure.

   EXCEPTIONS:

   1. Supply-water temperature reset is not required for chilled-water systems supplied by off-site district chilled water or chilled water from ice storage systems.
   2. Variable pump flow is not required on dedicated coil circulation pumps where needed for freeze protection.
   3. Variable pump flow is not required on dedicated equipment circulation pumps where configured in primary/secondary design to provide the minimum flow requirements of the equipment manufacturer for proper operation of equipment.
   4. Variable speed drives are not required on heating water pumps where more than 50 percent of annual heat is generated by an electric boiler.

Table C403.4.4
Variable Speed Drive (VSD) Requirements for Demand-Controlled Pumps

Climate Zones 4c, 5b	VSD Required for Motors with Rated Output of at Least
Heating water pumps	≥ ((~~7.5~~)) 5.0 hp
Chilled water and heat rejection loop pumps	≥ ((~~7.5~~)) 5.0 hp

C403.4.5 Pump isolation. Chilled water plants including more than one chiller shall be capable of and configured to reduce flow automatically through the chiller plant when a chiller is shut down and automatically shut off flow to chillers that are shut down. Chillers piped in series for the purpose of increased temperature differential shall be considered as one chiller.

Boiler systems including more than one boiler shall be capable of and configured to reduce flow automatically through the *boiler system* when a boiler is shut down.

C403.4.6 Variable flow controls. Individual pumps required by this code to have variable speed control shall be controlled in one of the following manners:

1. For systems having a combined pump motor horsepower less than or equal to 20 hp (15 kW) and without direct digital control of individual coils, pump speed shall be a function of either:
    1.1. Required differential pressure; or
    1.2. Reset directly based on zone hydronic demand, or other zone load indicators; or
    1.3. Reset directly based on pump power and pump differential pressure; or
    1.4. Reset directly by an integral controller based on the relationship between variable speed controller frequency and power.
2. For systems having a combined pump motor horsepower that exceeds 20 hp (15 kW) or smaller systems with direct digital control, pump speed shall be a function of either:
    2.1. The static pressure set point as reset based on the valve requiring the most pressure; or
    2.2. Directly controlled based on zone hydronic demand; or
    2.3. Reset directly by an integral controller based on the relationship between variable speed controller frequency and power.

C403.4.7 Combustion heating equipment controls. Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulating or staged combustion control.

EXCEPTIONS:

1. Boilers.
2. Radiant heaters.

C403.4.7.1 Combustion decorative vented appliance, combustion 2 and fire pit controls. Combustion decorative vented appliances, combustion fireplaces and fire pits shall be equipped with local controls to limit operation to a maximum duration of one hour without override hold capability or shall be controlled by occupancy sensor control configured with manual on and *automatic* shutoff within 15 minutes after occupants have left the space.

C403.4.8 Group R-1 hotel/motel guestrooms. See Section C403.7.4.

C403.4.9 Group R-2 and R-3 dwelling units. The primary space conditioning system within each *dwelling unit* shall be provided with at least one programmable thermostat for the regulation of space temperature. The thermostat shall allow for, at a minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable setback periods per day.

Each additional system provided within the *dwelling unit* shall be provided with at least one adjustable thermostat for the regulation of temperature.

EXCEPTIONS:

1. Systems controlled by an occupant sensor that is configured to shut the system off when no occupant is sensed for a period of up to 30 minutes.
2. Systems controlled solely by a manually operated timer configured to operate the system for no more than two hours.
3. Ductless heat pumps.

Each thermostat shall be capable of being set by adjustment or selection of sensors and configured as follows:

1. When used to control heating only: 55°F to 75°F.
2. When used to control cooling only: 70°F to 85°F.
3. All other: 55°F to 85°F with an adjustable dead band configured to at least 5°F in accordance with Section C403.4.1.2.

C403.4.10 Group R-2 sleeping units. The primary space conditioning system within each sleeping unit shall be provided with at least one programmable thermostat for the regulation of space temperature. The thermostat shall allow for, at a

minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable setback periods per day.

Each additional system provided within the sleeping unit shall be provided with at least one adjustable thermostat for the regulation of temperature.

EXCEPTIONS:

1. Systems controlled by an occupant sensor that is configured to shut the system off when no occupant is sensed for a period of up to 30 minutes.
2. Systems controlled solely by a manually operated timer configured to operate the system for no more than two hours.
3. *Zones* with a full HVAC load demand not exceeding 3,400 Btu/h (1 kW) and having a manual shutoff switch located with ready access.
4. Ductless heat pumps.

Each thermostat shall be capable of being set by adjustment or selection of sensors and configured as follows:

1. When used to control heating only: 55°F to 75°F;
2. When used to control cooling only: 70°F to 85°F;
3. All other: 55°F to 85°F with an adjustable dead band configured to at least 5°F in accordance with Section C403.4.1.2.

C403.4.11 Direct digital control systems. Direct digital control (DDC) shall be required as specified in Sections C403.4.11.1 through C403.4.11.4.

C403.4.11.1 DDC applications. DDC shall be provided in the applications and qualifications listed in Table C403.4.11.1 and for load management measures where installed to meet the requirements of Section C406.3.

C403.4.11.2 DDC controls. Where DDC is required by Section C403.4.11.1, the DDC system shall be configured to perform all of the following functions, as required to provide the system and zone control logic required in Sections C403.2, C403.5, C403.6.8 and C403.4.3:

1. Monitor zone and system demand for fan pressure, pump pressure, heating and cooling.
2. Transfer zone and system demand information from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers.

C403.4.11.3 DDC display. Where DDC is required by Section C403.4.11.1 for new buildings, the DDC system shall be configured to gather and provide trending data and graphically displaying input and output points.

C403.4.11.4 DDC demand response setpoint adjustment. Where DDC is required by Section C403.4.11.1 for new buildings and serve mechanical systems with a cooling capacity exceeding 780,000 Btu/h (2,662 kW), the *DDC system* shall be capable of demand response setpoint adjustment. The *DDC system* shall be configured with control logic to increase the cooling zone setpoints by at least 2°F (1°C) and reduce the heating zone setpoints by at least 2°F (1°C) when activated by a *demand response signal*. The *demand response signal* shall be a binary input to the control system or other interface approved by the serving electric utility.

Table C403.4.11.1
DDC Applications and Qualifications

Building Status	Application	Qualifications
New building	Air-handling system and all zones served by the system	Individual systems supplying more than three zones and with fan system bhp of 10 hp and larger
	Chilled-water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300,000 Btu/h and larger
	Hot-water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300,000 Btu/h and larger

Table C403.4.11.1—continued
DDC Applications and Qualifications

Building Status	Application	Qualifications
Alteration or addition	Zone terminal unit such as VAV box	Where existing zones served by the same air-handling, chilled-water, or hot-water system have DDC
	Air-handling system or fan coil	Where existing air-handling system(s) and fan coil(s) served by the same chilled- or hot-water plant have DDC
	New air-handling system and all new zones served by the system	Individual systems with fan system bhp of 10 hp and larger and supplying more than three zones and more than 75 percent of zones are new
	New or upgraded chilled-water plant	Where all chillers are new and plant design cooling capacity is 300,000 Btu/h and larger
	New or upgraded hot-water plant	Where all boilers are new and plant design heating capacity is 300,000 Btu/h and larger

C403.4.12 Pressure independent control valves. Where design flow rate of heating water and chiller water coils is 5 gpm or higher, modulating pressure independent control valves shall be provided.

C403.5 Economizers. Air economizers shall be provided on all new cooling systems including those serving computer server rooms, electronic equipment, radio equipment, and telephone switchgear. Economizers shall comply with Sections C403.5.1 through C403.5.5.

EXCEPTIONS:

1a. For other than Group R-2 occupancies, cooling system where the supply fan is not installed outside the *building thermal envelope* nor in a *mechanical room* adjacent to outdoors, and is installed in conjunction with DOAS complying with Section C403.3.5 and serving only spaces with year-round cooling loads from lights and equipment of less than 5 watts per square foot.

1b. For Group R-2 occupancies, cooling system where the supply fan is not installed outside the *building thermal envelope* nor in a *mechanical room* adjacent to outdoors, and is installed in conjunction with DOAS complying with Section C403.3.5, where the ERV/HRV has a minimum ((~~68~~)) 67 percent sensible recovery or 60 percent enthalpy recovery heating effectiveness, (((~~Exception 3 of Section C403.3.5.1 is not utilized),~~)) and serving only spaces with year-round cooling loads from lights and equipment of less than 5 watts per square foot.

2. Unitary or packaged systems serving one zone with dehumidification ((~~that affect other systems so as to~~)) where an air economizer would increase the overall building energy consumption. New humidification equipment shall comply with Section C403.3.2.7.

3. Unitary or packaged systems serving one zone where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.5(3).

4. Equipment serving chilled beams and chilled ceiling space cooling systems only which are provided with a water economizer meeting the requirements of Section C403.5.4.

5. For Group R occupancies, cooling unit where the supply fan is not installed outside the *building thermal envelope* or in a *mechanical room* adjacent to outdoors with a total cooling capacity less than 20,000 Btu/h and other cooling units with a total cooling capacity less than 54,000 Btu/h provided that these are high-efficiency cooling equipment with IEER, CEER, SEER, and EER values more than 15 percent higher than minimum efficiencies listed in Tables C403.3.2(1), C403.3.2(2), C403.3.2(4), C403.3.2(8) and C403.3.2(9) or an IPLV kW/ton that is at least 15 percent lower than the minimum efficiencies listed in Table C403.3.2(3) or C403.3.2(15), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. For split systems, compliance is based on the cooling capacity of individual fan coil units.

6. Equipment used to cool *Controlled Plant Growth Environments* provided these are high-efficiency cooling equipment with SEER, EER and IEER values a minimum of 20 percent greater than the values listed in Tables C403.3.2 (1), (3), (4), and (15).

7. Equipment serving a space with year-round cooling loads from lights and equipment of 5 watts per square foot or greater complying with the following criteria:

7.1. Equipment serving the space utilizes chilled water as the cooling source; and

7.2. The chilled water plant includes a condenser heat recovery system that meets the requirements of Section ((~~C403.9.5~~)) C403.9.2.1 or the building and water-cooled system meets the following requirements:

7.2.1. A minimum of 90 percent (capacity-weighted) of the building space heat is provided by hydronic heating water.

7.2.2. Chilled water plant includes a heat recovery chiller or water-to-water heat pump capable of rejecting heat from the chilled water system to the hydronic heating equipment capacity.

7.2.3. Heat recovery chillers shall have a minimum COP of 7.0 when providing heating and cooling water simultaneously.

8. Water-cooled equipment served by systems meeting the requirements of Section C403.9.2.4 Condenser heat recovery.

9. Dedicated outdoor air systems that include energy recovery as required by Section C403.7.6 but that do not include mechanical cooling.

10. Dedicated outdoor air systems not required by Section C403.7.6 to include energy recovery that modulate the supply airflow to provide only the minimum outdoor air required by Section C403.2.2.1 for ventilation, exhaust air make-up, or other process air delivery.

((~~9~~)) 11. Equipment used to cool any dedicated server room, electronic equipment room, elevator machine room or telecom switch room provided the system complies with Option a, b, ((~~or~~)) c, d or e in ((~~the table~~)) Table C403.5(9) below. The total cooling capacity of all fan systems qualifying under this exception without economizers shall not exceed 240,000 Btu/h per building or 10 percent of its *air economizer* capacity, whichever is greater. This exception shall not be used for Total Building Performance or Target Performance Path compliance.

((~~10. Dedicated outdoor air systems that include energy recovery as required by Section C403.7.6 but do not include mechanical cooling.~~

~~11. Dedicated outdoor air systems not required by Section C403.7.6 to include energy recovery that modulate the supply airflow to provide only the minimum outdoor air required by Section C403.2.2.1 for ventilation, exhaust air make-up, or other process air delivery.~~))

12. Medical and laboratory equipment that is directly water-cooled and is not dependent upon space air temperature.

Table C403.5(9)
Server room, electronic equipment room or telecom room cooling equipment

	Equipment Type	Higher Equipment Efficiency	Part-Load Control	Economizer
Option a	Tables C403.3.2(1), C403.3.2(2) and C403.3.2(14)[a]	+15%[b]	Required over 85,000 Btu/h[c]	None Required
Option b	Tables C403.3.2(1), C403.3.2(2) and C403.3.2(14)[a]	+5%[d]	Required over 85,000 Btu/h[c]	Waterside Economizer[e]
Option c	ASHRAE Standard 127[f]	+0%[g]	Required over 85,000 Btu/h[c]	Waterside Economizer[e]
Option d	Table C403.3.2(7)[h]	+ 25%[i]	Required for all chillers[i]	None Required
Option e	Table C403.3.2(7)[h]	+ 10/15%[k]	Required over 85,000 Btu/h[c]	Dedicated waterside Economizer[e]

Footnotes for Table C403.5(9):

a For a system where all of the cooling equipment is subject to the AHRI standards listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14), the system shall comply with ((~~all of the following~~)) the higher equipment efficiency, part-load control and economizer requirements of the row in which this footnote is located, including the associated footnotes (note that if the system contains any cooling equipment that exceeds the capacity limits in Table C403.3.2(1), C403.3.2(2), or C403.3.2 (14), or if the system contains any cooling equipment that is not included in Table C403.3.2(1), C403.3.2(2), or C403.3.2 (14), then the system is not allowed to use this option).

b The cooling equipment shall have a SEER/EER value and an IEER/IPLV value that each is a minimum of 15 percent greater than the value listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14).

c For units with a total cooling capacity over 85,000 Btu/h, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less that results in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not credited as a compressor unloading system).

d The cooling equipment shall have a SEER/EER value and an IEER/IPLV value that each is a minimum of 5 percent greater than the value listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14).

e The system shall include a water economizer in lieu of air economizer. Water economizers shall meet the requirements of C403.5.1 and C403.5.2 and be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 50°F dry-bulb/45°F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures. The equipment shall be served by a dedicated condenser water system unless a nondedicated condenser water system exists that can provide appropriate water temperatures during hours when waterside economizer cooling is available.

f For a system where all cooling equipment is subject to ASHRAE Standard 127, the system shall comply with the higher equipment efficiency, part-load control, and economizer requirements of the row in which this footnote is located, including the associated footnotes.

g The cooling equipment subject to the ASHRAE Standard 127 shall have an ((~~EER value and an IPLV~~)) SCOP value that is ((~~equal or~~)) a minimum of 10 percent greater than the value listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14) (1.10 × values in these tables) when determined in accordance

with the rating conditions ASHRAE Standard 127 (i.e., not the rating conditions in AHRI Standard 210/240 or 340/360). This information shall be provided by an independent third party.

h For a system with chillers subject to the AHRI standards listed in Table C403.3.2(7) (as an example, a chilled water system with fan coil units), the system shall comply with the higher equipment efficiency, part-load control and economizer requirements of the row in which this footnote is located, including the associated footnotes.

i The cooling equipment shall have an full-load EER value and an IPLV value that is a minimum of 25 percent greater than the value listed in Table C403.3.2(7) (1.25 × value in Table C403.3.2(7) or a full-load and IPLV kW/ton that is at least 25 percent lower than the value listed in Table C403.3.2(7) (0.75 × value in Table C403.3.2(7)).

j For all chillers, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less and that result in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, or dual tandem scrolls, but hot gas bypass is not a qualifying compressor unloading system).

k For air-cooled chillers, the cooling equipment shall have an IPLV EER value that is a minimum of 10 percent greater than the IPLV EER value listed in Table C403.3.2(7) (1.10 × values in Table C403.3.2(7). For water-cooled chillers, the cooling equipment shall have an IPLV kW/ton that is at least 15 percent lower than the IPLV kW/ton value listed in Table C403.3.2(7) (0.85 × values in Table C403.3.2(7)).

Table C403.5(3)
Equipment Efficiency Performance

Climate Zones	Efficiency Improvement[a]
4C	64%
5B	59%

[a] If a unit is rated with an IPLV, IEER or SEER then to eliminate the required air or water economizer, the minimum cooling efficiency of the HVAC unit must be increased by the percentage shown. If the HVAC unit is only rated with a full load metric like EER or COP cooling, then these must be increased by the percentage shown.

C403.5.1 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be configured to provide partial cooling even where additional mechanical cooling is required to provide the remainder of the cooling load. Controls shall not be capable of creating a false load in the mechanical cooling system by limiting or disabling the economizer or any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

Units that include an *air economizer* shall comply with the following:

1. Unit controls shall have the mechanical cooling capacity control interlocked with the *air economizer* controls such that the outdoor air damper is at the 100 percent open position when mechanical cooling is on and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F (7°C).
2. Direct expansion (DX) units with cooling capacity 65,000 Btu/H (19 kW) or greater of rated capacity shall comply with the following:
   2.1. DX units that control the capacity of the mechanical cooling directly based on occupied space temperature shall have not fewer than two stages of mechanical cooling capacity.
   2.2. Other DX units, including those that control space temperature by modulating the airflow to the space, shall be in accordance with Table C403.5.1.

TABLE C403.5.1
DX COOLING STAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS

Rating Capacity	Minimum Number of Mechanical Cooling Stages	Minimum Compressor Displacement[a]
≥ 65,000 Btu/h and < 240,000 Btu/h	3 stages	≤ 35% of full load
≥ 240,000 Btu/h	4 stages	≤ 25% of full load

For SI: 1 Btu/h = 0.2931 W

a. For *mechanical cooling* stage control that does not use variable compressor displacement, the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

C403.5.2 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase building heating energy use during normal operation.

EXCEPTION: Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.

C403.5.3. Air economizers. *Air economizers* shall comply with Sections C403.5.3.1 through C403.5.3.5.

C403.5.3.1 Design capacity. *Air economizer* systems shall be configured to modulate *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

C403.5.3.2 Control signal. Economizer controls and dampers shall be configured to sequence the dampers with mechanical cooling equipment and shall not be controlled by only mixed air temperature. *Air economizers* on systems with cooling capacity greater than 65,000 Btu/h shall be configured to provide partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

C403.6.4 Supply-air temperature reset controls. Multiple *zone* HVAC systems shall include controls that are capable of and configured to automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls shall be configured to reset the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature. Controls that adjust the reset based on zone humidity are allowed. HVAC zones that are expected to experience relatively constant loads shall have maximum airflow designed to accommodate the fully reset supply air temperature.

EXCEPTIONS:

1. Systems that prevent reheating, recooling or mixing of heated and cooled supply air.
2. Seventy-five percent of the energy for reheating is from a site-recovered source.

C403.6.5 Multiple-zone VAV system ventilation optimization control. Multiple-zone VAV systems with direct digital control of individual zone boxes reporting to a central control panel shall have automatic controls configured to reduce outdoor air intake flow below design rates in response to changes in system ventilation efficiency (E_v) as defined by the *International Mechanical Code*.

EXCEPTIONS:

1. VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan-powered terminal units.
2. Systems where total design exhaust airflow is more than 70 percent of total design outdoor air intake flow requirements.

C403.6.6 Parallel-flow fan-powered VAV air terminal control. Parallel-flow fan-powered VAV air terminals shall have automatic controls configured to:

1. Turn off the terminal fan except when space heating is required or where required for ventilation.
2. Turn on the terminal fan as the first stage of heating before the heating coil is activated.
3. During heating for warmup or setback temperature control, either:
   3.1. Operate the terminal fan and heating coil without primary air.
   3.2. Reverse the terminal damper logic and provide heating from the central air handler by primary air.

C403.6.7 Reserved.

C403.6.8 Set points for direct digital control. For systems with direct digital control of individual *zones* reporting to the central control panel, the static pressure setpoint shall be reset based on the *zone* requiring the most pressure. In such cases, the set point is reset lower until one zone damper is nearly wide open. The direct digital controls shall be capable of monitoring zone damper positions or shall have an alternative method of indicating the need for static pressure that is configured to provide all of the following:

1. Automatically detecting any zone that excessively drives the reset logic.
2. Generating an alarm to the system operational location.
3. Allowing an operator to readily remove one or more zones from the reset algorithm.

C403.6.9 Static pressure sensor location. Static pressure sensors used to control VAV fans shall be located such that the controller setpoint is no greater than 1.2 inches w.c. (299 Pa). Where this results in one or more sensors being located downstream of major duct splits, not less than one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

EXCEPTION: Systems complying with Section C403.6.8.

C403.6.10 High efficiency variable air volume (VAV) systems. For HVAC systems subject to the requirements of Section C403.3.5 but utilizing Exception 2 of that section, a high efficiency multiple-zone VAV system may be provided without a separate parallel DOAS when the system is designed, installed, and configured to comply with all of the following criteria (this exception shall not be used as a substitution for a DOAS per Section C406.6):

1. Each VAV system must serve a minimum of 3,000 square feet (278.7 m^2) and have a minimum of five VAV zones.
2. The VAV systems are provided with airside economizer per Section C403.5 without exceptions.
3. A direct-digital control (DDC) system is provided to control the VAV air handling units and associated terminal units per Section C403.4.11 regardless of sizing thresholds of Table C403.4.11.1.
4. Multiple-zone VAV systems with a minimum outdoor air requirement of 2,500 cfm (1180 L/s) or greater shall be equipped with a device capable of measuring outdoor airflow intake under all load conditions. The system shall be capable of increasing or reducing the outdoor airflow intake based on feedback from the VAV terminal units as required by Section C403.6.5, without exceptions, and Section C403.7.1 demand controlled ventilation.

5. Multiple-zone VAV systems with a minimum outdoor air requirement of 2,500 cfm (1180 L/s) or greater shall be equipped with a device capable of measuring supply airflow to the VAV terminal units under all load conditions.
6. In addition to meeting the zone isolation requirements of C403.2.1 a single VAV air handling unit shall not serve more than 50,000 square feet (4645 m^2) unless a single floor is greater than 50,000 square feet (4645 m^2) in which case the air handler is permitted to serve the entire floor.
7. The primary maximum cooling air for the VAV terminal units serving interior cooling load driven zones shall be sized for a supply air temperature that is a minimum of 5°F greater than the supply air temperature for the exterior zones in cooling.
8. Air terminal units with a minimum primary airflow setpoint of 50 percent or greater of the maximum primary airflow setpoint shall be sized with an inlet velocity of no greater than 900 feet per minute. ((~~Allowable fan motor horsepower shall not exceed 90 percent of the allowable HVAC *fan system bhp* (Option 2) as defined by Section C403.8.1.1.~~))
9. ((~~Allowable fan power shall not exceed 90 percent of the allowable fan power budget as defined by Section C403.8.1.1.~~)) *Fan system electrical input power* (Fan $kW_{design,system}$) shall not exceed 90 percent of the fan power budget (Fan kW_{budget}) as defined by Section C403.8.1.
10. All fan powered VAV terminal units (series or parallel) shall be provided with electronically commutated motors. The DDC system shall be configured to vary the speed of the motor as a function of the heating and cooling load in the space. Minimum speed shall not be greater than 66 percent of design airflow required for the greater of heating or cooling operation. Minimum speed shall be used during periods of low heating and cooling operation and ventilation-only operation.

    EXCEPTION: For series fan powered terminal units where the volume of primary air required to deliver the ventilation requirements at minimum speed exceeds the air that would be delivered at the speed defined above, the minimum speed setpoint shall be configured to exceed the value required to provide the required ventilation air.
11. Fan-powered VAV terminal units shall only be permitted at perimeter zones with an envelope heating load requirement. All other VAV terminal units shall be single duct terminal units.

    EXCEPTION: Fan powered VAV terminal units are allowed at interior spaces with an occupant load greater than or equal to 25 people per 1000 square feet of floor area (as established in Table 403.3.1.1 of the *International Mechanical Code*) with demand control ventilation in accordance with Section C403.7.1.
12. When in occupied heating or in occupied deadband between heating and cooling all fan powered VAV terminal units shall be configured to reset the primary air supply setpoint, based on the VAV air handling unit outdoor air vent fraction, to the minimum ventilation airflow required per *International Mechanical Code*.
13. Spaces that are larger than 150 square feet (14 m^2) and with an occupant load greater than or equal to ((~~25~~)) 15 people per 1000 square feet (93 m^2) of floor area (as established in Table 403.3.1.1 of the *International Mechanical Code*) shall be provided with all of the following features:
    13.1. A dedicated VAV terminal unit capable of controlling the space temperature and minimum ventilation shall be provided.
    13.2. Demand control ventilation (DCV) shall be provided that utilizes a carbon dioxide sensor to reset the ventilation setpoint of the VAV terminal unit from the design minimum to design maximum ventilation rate as required by Chapter 4 of the *International Mechanical Code*.
    13.3. Occupancy sensors shall be provided that are configured to reduce the minimum ventilation rate to zero and setback room temperature setpoints by a minimum of 5°F, for both cooling and heating, when the space is unoccupied.
14. Dedicated data centers, computer rooms, electronic equipment rooms, telecom rooms, or other similar spaces with cooling loads greater than 5 watts/sf shall be provided with separate cooling systems to allow the VAV air handlers to turn off during unoccupied hours in the office space and to allow the supply air temperature reset to occur.

    EXCEPTION: The VAV air handling unit and VAV terminal units may be used for secondary backup cooling when there is a failure of the primary HVAC system.

Additionally, computer rooms, electronic equipment rooms, telecom rooms, or other similar spaces shall be provided with airside economizer in accordance with Section 403.5 without using the exceptions to Section C403.5.

EXCEPTION: Heat recovery per Exception 9 of Section C403.5 may be in lieu of airside economizer for the separate, independent HVAC system.

15. HVAC system central heating or cooling plant will include a minimum of one of the following options:
    15.1. VAV terminal units with hydronic heating coils connected to systems with hot water generation equipment limited to the following types of equipment: ((~~Gas-fired hydronic boilers with a thermal efficiency, E_t, of~~

~~not less than 92 percent,~~)) air-to-water heat pumps, ground-source water-to-water heat pumps, wastewater heat recovery water-to-water heat pumps, or heat recovery chillers. Hydronic heating coils shall be sized for a maximum entering hot water temperature of 120°F (48.9°C) for peak anticipated heating load conditions.

15.2. Chilled water VAV air handing units connected to systems with chilled water generation equipment with IPLV values more than 25 percent higher than the minimum part load efficiencies listed in Table C403.3.2(3), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify. The smallest chiller or compressor in the central plant shall not exceed 20 percent of the total central plant cooling capacity or the chilled water system shall include thermal storage sized for a minimum of 20 percent of the total central cooling plant capacity.

16. The DDC system shall include a fault detection and diagnostics (FDD) system complying with the following:

16.1. The following temperature sensors shall be permanently installed to monitor system operation:

16.1.1. Outside air.

16.1.2. Supply air.

16.1.3. Return air.

16.2. Temperature sensors shall have an accuracy of ±2°F (1.1°C) over the range of 40°F to 80°F (4°C to 26.7°C).

16.3. The VAV air handling unit controller shall be configured to provide system status by indicating the following:

16.3.1. Free cooling available.

16.3.2. Economizer enabled.

16.3.3. Compressor enabled.

16.3.4. Heating enabled.

16.3.5. Mixed air low limit cycle active.

16.3.6. The current value of each sensor.

16.4. The VAV air handling unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and the heating system can be independently tested and verified.

16.5. The VAV air handling unit shall be configured to report faults to a fault management application able to be accessed by day-to-day operating or service personnel or annunciated locally on zone thermostats.

16.6. The VAV terminal unit shall be configured to report if the VAV inlet valve has failed by performing the following diagnostic check at a maximum interval of once a month:

16.6.1. Command VAV terminal unit primary air inlet valve closed and verify that primary airflow goes to zero or other *approved* means to verify that the VAV terminal unit damper actuator and flow ring are operating properly.

16.6.2. Command VAV terminal unit primary air inlet valve to design airflow and verify that unit is controlling to within 10 percent of design airflow.

16.7. The VAV terminal unit shall be configured to report and trend when the zone is driving the following VAV air handling unit reset sequences. The building operator shall have the capability to exclude zones used in the reset sequences from the DDC control system graphical user interface:

16.7.1. Supply air temperature setpoint reset to lowest supply air temperature setpoint for cooling operation.

16.7.2. Supply air duct static pressure setpoint reset for the highest duct static pressure setpoint allowable.

16.8. The FDD system shall be configured to detect the following faults:

16.8.1. Air temperature sensor failure/fault.

16.8.2. Not economizing when the unit should be economizing.

16.8.3. Economizing when the unit should not be economizing.

16.8.4. Outdoor air or return air damper not modulating.

16.8.5. Excess outdoor air.

16.8.6. VAV terminal unit primary air valve failure.

C403.7.3 Ventilation air heating control. For ventilation air units with supplemental heating capacity that operate in conjunction with zone heating and cooling systems, supplemental heating shall not warm ventilation supply air to a temperature greater than 55°F (13°C).

C403.7.4 Automatic control of HVAC systems serving guestrooms. In Group R-1 buildings containing more than 50 guestrooms, each guestroom shall be provided with controls complying with the provisions of Sections C403.7.4.1 and C403.7.4.2. Card key controls comply with these requirements.

C403.7.4.1 Temperature setpoint controls. Controls shall be provided on each HVAC system that are capable of and configured with three modes of temperature control.

1. When the guestroom is rented but unoccupied, the controls shall automatically raise the cooling setpoint and lower the heating setpoint by not less than 4°F (2°C) from the occupant setpoint within 30 minutes after the occupants have left the guestroom.
2. When the guestroom is unrented and unoccupied, the controls shall automatically raise the cooling setpoint to not lower than 80°F (27°C) and lower the heating setpoint to not higher than 60°F (16°C). Unrented and unoccupied guestroom mode shall be initiated within 16 hours of the guestroom being continuously occupied or where a *networked guestroom control system* indicates that the guestroom is unrented and the guestroom is unoccupied for more than 20 minutes. A *networked guestroom control system* that is capable of returning the thermostat setpoints to default occupied setpoints 60 minutes prior to the time a guestroom is scheduled to be occupied is not precluded by this section. Cooling that is capable of limiting relative humidity with a setpoint not lower than 65 percent relative humidity during unoccupied periods is not precluded by this section.
3. When the guestroom is occupied, HVAC set points shall return to their occupied set point once occupancy is sensed.

C403.7.4.2 Ventilation controls. Controls shall be provided on each HVAC system that are capable of and configured to automatically turn off the ventilation and exhaust fans within 20 minutes of the occupants leaving the guestroom or isolation devices shall be provided to each guestroom that are capable of automatically shutting off the supply of outdoor air to and exhaust air from the guestroom.

EXCEPTION: Guestroom ventilation systems are not precluded from having an automatic daily preoccupancy purge cycle that provides daily outdoor air ventilation during unrented periods at the design ventilation rate for 60 minutes, or at a rate and duration equivalent to one air change.

C403.7.5 Loading dock, motor vehicle repair garage, and parking garage ventilation system controls. Mechanical ventilation systems for loading docks, motor vehicle repair garages, and parking garages shall be designed to exhaust the airflow rates (maximum and minimum) determined in accordance with the *International Mechanical Code*.

Ventilation systems shall be equipped with a control device that operates the system automatically by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Controllers shall be configured to shut off fans or modulate fan speed to 20 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with the *International Mechanical Code* provisions.

Ventilation systems with total ventilation system motor nameplate horsepower exceeding 5 hp (3.7 kW) at fan system design conditions and those with heating and/or cooling shall have controls and devices that modulate fan speed and result in fan motor demand of no more than 30 percent of design wattage at 50 percent of the design airflow.

Gas sensor controllers used to activate the exhaust ventilation system shall stage or modulate fan speed upon detection of specified gas levels. All equipment used in sensor controlled systems shall be designed for the specific use and installed in accordance with the manufacturer's recommendations. The system shall be arranged to operate automatically by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Parking garages, repair garages, and loading docks shall be equipped with a controller and a full array of carbon monoxide (CO) sensors set to maintain levels of carbon monoxide below 35 parts per million (ppm). Additionally, a full array of nitrogen dioxide detectors shall be connected to the controller set to maintain the nitrogen dioxide level below the OSHA standard for eight hour exposure.

Spacing and location of the sensors shall be installed in accordance with manufacturer recommendations.

C403.7.5.1 System activation devices for loading docks. Ventilation systems for enclosed loading docks shall operate continuously during unoccupied hours at 50 percent or less of design capacity and shall be activated to the full required ventilation rate by one of the following:

1. Gas sensors installed in accordance with the *International Mechanical Code*, Section 404; or
2. Occupant detection sensors used to activate the system that detects entry into the loading area along both the vehicle and pedestrian pathways.

C403.7.5.2 System activation devices for parking garages. Ventilation systems for enclosed parking garages shall be activated by gas sensors to activate the full required ventilation rate in accordance with the *International Mechanical Code*, Section 404.

C403.7.6 Energy recovery ventilation systems. Energy recovery ventilation systems shall be provided as specified in Sections C403.7.6.1 and C403.7.6.2.

C403.7.6.1 Ventilation for Group R-2 occupancy. For all Group R-2 dwelling and sleeping units, a balanced ventilation system with heat recovery system with minimum ((~~60~~)) 67 percent sensible recovery effectiveness shall provide outdoor air directly to each habitable space in accordance with the *International Mechanical Code*. The ventilation system shall allow for the design flow rates to be tested and verified at each habitable space as part of the commissioning process in accordance with Section C408.2.2. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C), or as calculated by the *registered design professional*.

EXCEPTION: Heat recovery and energy recovery ventilators (H/ERVs) that are rated and listed in accordance with HVI 920 can demonstrate compliance with the sensible recovery effectiveness requirement using the sensible recovery effectiveness (ASRE) rating of the equipment at 32°F test conditions. Applied flow rate for ASRE rating shall be no less than the design flow rate or the closest value interpolated between two listed flow rates.

C403.7.6.2 Spaces other than Group R-2 dwelling or sleeping units. Any system serving a space other than a Group R-2 dwelling or sleeping unit with minimum ((~~outside~~)) outdoor air requirements at design conditions greater than 5,000 cfm or any system where the system's supply airflow rate exceeds the value listed in Tables C403.7.6(1) and C403.7.6(2), based on the climate zone and percentage of outdoor airflow rate at design conditions, shall include an energy recovery system. Table C403.7.6(1) shall be used for all ventilation systems that operate less than 8,000 hours per year, and Table C403.7.6(2) shall be used for all ventilation systems that operate 8,000 hours or more per year. The energy recovery system shall provide a ((~~68~~)) 67 percent minimum sensible recovery effectiveness or have an *enthalpy recovery ratio* of not less than 60 percent at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass of the energy recovery media for both the outdoor air and exhaust air or return air dampers and controls which permit operation of the air economizer as required by Section C403.5. Where a single room or space is supplied by multiple units, the aggregate ventilation (cfm) of those units shall be used in applying this requirement. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C) at 30 percent relative humidity, or as calculated by the registered design professional.

SDCI Informative Note: In Seattle, the energy recovery effectiveness is determined typically by the winter heat recovery condition. See example below for how the minimum supply air enthalpy leaving the energy recovery media is calculated for the winter condition:

1. In Seattle, the winter outdoor design air temperature is 24°F as specified in Appendix C. The registered design professional shall determine the coincident winter wet bulb temperature or percent relative humidity at the anticipated design conditions. Based on these conditions the outdoor design air enthalpy is determined from a psychrometric chart.
2. Determine the return/exhaust air stream enthalpy from a psychrometric chart based on the 70°F (21°C) at 30 percent relative humidity.
3. Calculate the 60% difference between the outside air and return air enthalpies at design winter conditions.
4. See example below:
   a. OA Enthalpy at 24°F/23°F (drybulb/wetbulb) = 8.2 BTU/LB
   b. RA/EA Enthalpy at 70°F and 30% RH = 21.9 BTU/LB
   c. SA Enthalpy Minimum Leaving Energy Recovery Media
      = (8.2 + (21.9 - 8.2)*60%)
      = 16.42 BTU/LB

(Note that this example represents 60% enthalpy recovery. For an equivalent sensible-only recovery system, it would take 73.9% effectiveness (increasing from 24°F DB to 58°F DB) to achieve the same enthalpy recovery.)

EXCEPTION: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are restricted per Section 514 of the *International Mechanical Code* to sensible energy recovery, the system shall comply with one of the following:
   1.1. Kitchen exhaust systems where they comply with Section C403.7.7.1.
   1.2. Laboratory fume ((~~hood~~)) exhaust systems where they comply with ((~~Exception 2 of Section C403.7.6~~)) Section C403.7.7.2.
   1.3. Other sensible energy recovery systems with the capability to provide a change in dry-bulb temperature of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and the return air dry-bulb temperatures, at design conditions. Where an air economizer is required, the energy

recovery system shall include a bypass of the energy recovery media for both the outdoor air and exhaust air.

2. Buildings with laboratory fume ((~~hood~~)) exhaust systems having a total exhaust rate less than or equal to 5,000 cfm (2360 L/s) ((~~that~~)) shall include at least one of the following features ((~~and also~~)) or shall comply with Section C403.7.7.2:
   2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.
   2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and are not cooled.
4. Where more than 60 percent of the outdoor air heating energy is provided from site-recovered energy.
5. Systems exhausting hazardous, toxic, flammable, paint or corrosive fumes or dust. This exception may not be used for laboratory fume exhaust systems required to comply with Exception 2 of Section C403.7.6 or Section C403.7.7.2 without approval of the code official.
6. Cooling energy recovery.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Multiple-zone systems where the supply airflow rate is less than the values specified in Tables C403.7.6 (1) and (2), for the corresponding percent of outdoor air. Where a value of NR is listed, energy recovery shall not be required.
9. Equipment which meets the requirements of Section C403.9.2.4.
10. Systems serving Group R-1 dwelling or sleeping units where the largest source of air exhausted at a single location at the building exterior is less than 25 percent of the design outdoor air flow rate.
11. Systems serving Ambulatory Care Facilities and Group I-2 Occupancies ventilated in accordance with Section 407 of the *International Mechanical Code*, systems exhausting environmental exhaust air in research or education laboratory spaces complying with the Seattle Director's Rule alternate of Section 510 of the International Mechanical Code, and systems exhausting environmental exhaust air in spaces that have Hazardous Exhaust Systems complying with Section 510 of the *International Mechanical Code*, are permitted to provide a 60 percent minimum sensible heat recovery effectiveness or have an enthalpy heat recovery ratio of not less than 50 percent at design conditions. Where an air economizer is required, the energy or heat recovery system shall include a bypass of the energy or heat recovery media for both the outdoor air and exhaust air.

Table C403.7.6(1)
Energy Recovery Requirement

Percent (%) Outdoor Air at Full Design Airflow Rate								
Climate zone	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
Design Supply Fan Airflow Rate (cfm)								
4C, 5B	NR	NR	NR	NR	NR	NR	≥ 5000	≥ 5000

NR = Not required.

Table C403.7.6(2)
Energy Recovery Requirement

Percent (%) Outdoor Air at Full Design Airflow Rate								
Climate zone	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
Design Supply Fan Airflow Rate (cfm)								
4C	NR	≥ 19500	≥ 9000	≥ 5000	≥ 4000	≥ 3000	≥ 1500	≥ 120
5B	≥ 2500	≥ 2000	≥ 1000	≥ 500	≥ 140	≥ 120	≥ 100	≥ 80

NR = Not required.

C403.7.7 Exhaust systems.

C403.7.7.1 Kitchen exhaust systems.

C403.7.7.1.1 Replacement air. Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10 percent of the hood exhaust airflow rate.

C403.7.7.1.2 Kitchen exhaust hood certification and maximum airflow. Where a kitchen or kitchen/dining facility has a total kitchen hood exhaust airflow rate that is greater than 2,000 cfm, each hood shall be a factory built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710 and each hood shall have a maximum exhaust rate as specified in Table C403.7.7.1.2. Where a single hood, or hood section, is installed over appliances with different duty ratings, the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

EXCEPTION: Type II dishwasher exhaust hoods that have an exhaust airflow of 1000 cfm or less.

Table C403.7.7.1.2
Maximum Net Exhaust Flow Rate, CFM Per Linear Foot of Hood Length

Type of Hood	Light-duty Equipment	Medium-duty Equipment	Heavy-duty Equipment	Extra-heavy-duty Equipment
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	NA	NA
Backshelf/pass-over	210	210++++	280	NA

For SI: 1 cfm = 0.4719 L/s; 1 foot = 305 mm
NA = Not allowed

C403.7.7.1.3 Kitchen exhaust hood system. Kitchen exhaust hood systems serving Type I exhaust hoods shall be provided with *demand control kitchen ventilation* (DCKV) controls where a kitchen or kitchen/dining facility has a total kitchen hood exhaust airflow rate greater than 2000 cfm. DCKV systems shall be configured to provide a minimum of 50 percent reduction in exhaust and replacement air system airflows in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle operation.

EXCEPTIONS:

1. UL 710 listed exhaust hoods that have a design maximum exhaust airflow rate no greater than 250 cfm per linear foot of hood that serve kitchen or kitchen/dining facilities with a total kitchen hood exhaust airflow rate less than 5000 cfm.
2. An energy recovery device is installed on the kitchen exhaust with a sensible heat recovery effectiveness of not less than 40 percent or not less than 50 percent of the total exhaust hood airflow.

C403.7.7.2 Laboratory fume exhaust systems. Buildings with laboratory fume exhaust systems having a total exhaust rate greater than 5,000 cfm (2360 L/s) shall include heat recovery systems to precondition replacement air from laboratory fume exhaust. The heat recovery system shall be capable of increasing the outside air supply temperature at design heating conditions by 25°F (13.9°C). A provision shall be made to bypass or control the heat recovery system to permit air economizer operation as required by Section C403.5.

EXCEPTIONS:

1. Variable air volume laboratory fume exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values; or
2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the fume exhaust rate, heated no warmer than 2°F (1.1°C) below room setpoint, cooled to no cooler than 3°F (1.7°C) above room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control; or
3. Combined energy reduction method: VAV fume exhaust and room supply system configured to reduce fume exhaust and makeup air volumes and a heat recovery system to precondition makeup air from laboratory fume exhaust that when combined will produce the same energy reduction as achieved by a heat recovery system with a 50 percent sensible recovery effectiveness as required above. For calculation purposes, the heat recovery component can be assumed to include the maximum design supply airflow rate at design conditions. The combined energy reduction (Q_{ER}) shall meet the following:

$$Q_{ER} \geq Q_{MIN}$$

$$Q_{MIN} = CFM_S \bullet (T_R - T_O) \bullet 1.1 \bullet 0.6$$

$$Q_{ER} = CFM_S \bullet (T_R - T_O) \bullet 1.1(A + B)/100$$

Where:

Q_{MIN} = Energy recovery at 60 percent sensible effectiveness (Btu/h)

Q_{ER} = Combined energy reduction (Btu/h)

CFM_S = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute

T_R = Space return air dry-bulb at winter design conditions

T_O = Outdoor air dry-bulb at winter design conditions

A = Percentage that the exhaust and makeup air volumes can be reduced from design conditions

B = Percentage sensible heat recovery effectiveness

C403.7.7.3 Transfer air. Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of:

1. The supply flow required to meet the space heating or cooling load;
2. The ventilation rate required by the authority having jurisdiction, the facility environmental health and safety department, or Section C403.2.2; or
3. The mechanical exhaust flow minus the available transfer air from conditioned spaces or return air plenums that at their closest point are within 15 feet of each other on the same floor that are not in different smoke or fire compartments. Available transfer air is that portion of outdoor ventilation air that:
   3.1. Is not required to satisfy other exhaust needs;
   3.2. Is not required to maintain pressurization of other spaces; and
   3.3. Is transferable according to applicable codes and standards and per the *International Mechanical Code*.

EXCEPTIONS:

1. Laboratories classified as biosafety level 3 or higher.
2. Vivarium spaces.
3. Spaces that are required by applicable codes and standards to be maintained at positive pressure relative to adjacent spaces. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy.
4. Spaces where the demand for transfer air may exceed the available transfer airflow rate and where the spaces have a required negative pressure relationship. For spaces taking this exception, any transferable air that is not directly transferred shall be made available to the associated air-handling unit and shall be used whenever economizer or other options do not save more energy.

C403.7.8 Shutoff dampers. Mechanical openings shall be provided with shutoff dampers in accordance with Sections C403.7.8.1 through C403.7.8.4.

C403.7.8.1 Shutoff dampers for building isolation. Outdoor air supply, exhaust openings and relief outlets and stairway and elevator hoistway shaft vents shall be provided with Class I motorized dampers. See Sections C403.10.1 and C403.10.2 for ductwork insulation requirements upstream and downstream of the shutoff damper.

EXCEPTIONS:

1. Gravity (nonmotorized) dampers shall be permitted in lieu of motorized dampers as follows:
   1.1. Relief dampers serving systems less than ((~~5,000~~)) 300 cfm total supply shall be permitted ((~~in buildings less than three stories in height.~~))
   1.2. Gravity (nonmotorized) dampers where the design outdoor air intake or exhaust capacity does not exceed 300 cfm (142 L/s).
   1.3. Systems serving areas which require continuous operation for 24/7 occupancy schedules.
2. Shutoff dampers are not required in:
   2.1. Combustion air intakes.

2.2. Systems serving areas which require continuous operation in animal hospitals, kennels and pounds, laboratories, and Group H, I and R occupancies.

2.3. Subduct exhaust systems or other systems that are required to operate continuously by the *International Mechanical Code*.

2.4. Type I grease exhaust systems or other systems where dampers are prohibited by the *International Mechanical Code* to be in the airstream.

2.5. Unconditioned stairwells or unconditioned elevator hoistway shafts that are only connected to unconditioned spaces.

C403.7.8.2 Shutoff dampers for return air. Return air openings used for airside economizer operation shall be equipped with Class I motorized dampers.

C403.7.8.3 Damper leakage rating. Class 1 dampers shall have a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s × m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D and shall be labeled by an approved agency for such purpose. Gravity (nonmotorized) dampers shall have an air leakage rate not greater than 20 cfm/ft^2 where not less than 24 inches (610 mm) in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch w.g. (249 Pa) when tested in accordance with AMCA 500D for such purpose. The dampers shall be labeled by an approved agency. Gravity dampers for ventilation air intakes shall be protected from direct exposure to wind.

EXCEPTIONS:

1. Gravity (nonmotorized) dampers are not required to be tested to verify the air leakage rating when installed in exhaust systems where the exhaust capacity does not exceed 400 cfm and the gravity damper is provided with a gasketed seal.
2. Motorized dampers on return air openings in unitary packaged equipment that have the minimum leakage rate available from the manufacturer.

C403.7.8.4 Damper actuation. Outdoor air intake, relief and exhaust shutoff dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation, unless the systems served require outdoor or exhaust air in accordance with the *International Mechanical Code* or the dampers are opened to provide intentional economizer cooling. Stairway and elevator hoistway shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper.

C403.8 Fan and fan controls. Fans in HVAC systems shall comply with Sections C403.8.1 through C403.8.5.1. The airflow requirements of Section C403.8.5.1 shall apply to all fan motors. Low capacity ventilation fans shall also comply with Section C403.8.4.

C403.8.1 Fan System. Each *fan system* that includes at least one fan or fan array with *fan electrical input power* ≥ 1 kW, moving air into, out of, or between conditioned spaces or circulating air for the purpose of conditioning air within a space shall comply with Sections C403.8.1.1 through C403.8.1.2.

C403.8.1.1 Determining fan power budget. For each *fan system*, the *fan system electrical input power* (Fan $kW_{design,system}$) determined in accordance with Section C403.8.1.2 at the *fan system airflow* shall not exceed Fan kW_{budget}. Calculate fan power budget (Fan kW_{budget}) for each fan system as follows:

1. Determine the *fan system airflow* and choose the appropriate table(s) for fan power allowance.
   1.1. For *single-cabinet fan systems*, use the *fan system airflow* and the power allowances in both Table C403.8.1.1(1) and Table C403.8.1.1(2).
   1.2. For *supply-only fan systems*, use the *fan system airflow* and power allowances in Table C403.8.1.1(1).
   1.3. For *relief fan systems*, use the design relief airflow and the power allowances in Table C403.8.1.1(2).
   1.4. For exhaust, return and transfer *fan systems*, use the *fan system airflow* and the power allowances in Table C403.8.1.1(2).
   1.5. For complex and DOAS with energy recovery *fan systems*, separately calculate the *fan power* allowance for the supply and return/exhaust systems and sum them. For the supply airflow, use supply airflow at the *fan system* design conditions, and the power allowances in Table C403.8.1.1(1). For the return/exhaust airflow, use return/exhaust airflow at the *fan system* design conditions, and the power allowances in Table C403.8.1.1(2).
2. For each *fan system*, determine the components included in the fan system and sum the fan power allowances of those components. All fan systems shall include the system base allowance. If, for a given component, only a portion of the fan system airflow passes through the component, calculate the fan power allowance for that component in accordance with Equation 4-11:

1. Use the default *Fan* kW_{design} in Table C403.8.1.2 for one or more of the fans. This method cannot be used for *complex fan systems*.
2. Use the *Fan* kW_{design} at *fan system design conditions* provided by the manufacturer of the fan, fan array, or equipment that includes the fan or fan array calculated per a test procedure included in 10 C.F.R. Part 430, 10 C.F.R. Part 431, ANSI/AMCA 208, ANSI/AMCA S210, AHRI 430, AHRI 440, or ISO 5801.
3. Use the *Fan* kW_{design} provided by the manufacturer, calculated at *fan system design conditions* per one of the methods listed in Section 5.3 of ANSI/AMCA 208.
4. Determine the *Fan* kW_{design} by using the maximum electrical input power provided on the motor nameplate.

Table C403.8.1.2
Default Values for Fan kW_{design} Based on Motor Nameplate HP[a,b]

Motor Nameplate HP	Default *Fan* kW_{design} with variable speed drive (Fan kW_{design})	Default *Fan* kW_{design} without variable speed drive (Fan kW_{design})
<1	0.96	0.89
≥1 and <1.5	1.38	1.29
≥1.5 and <2	1.84	1.72
≥2 and <3	2.73	2.57
≥3 and <5	4.38	4.17
≥5 and <7.5	6.43	6.15
≥7.5 and <10	8.46	8.13
≥10 and <15	12.4	12.0
≥15 and <20	16.5	16.0
≥20 and <25	20.5	19.9
≥25 and <30	24.5	23.7
≥30 and <40	32.7	31.7
≥40 and <50	40.7	39.4
≥50 and <60	48.5	47.1
≥60 and <75	60.4	58.8
≥75 and ≤100	80.4	78.1

C403.8.2 Motor nameplate horsepower. For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower (bhp). The fan brake horsepower (bhp) shall be indicated on the design documents to allow for compliance verification by the *code official*.

EXCEPTIONS:

1. For fans less than 6 bhp (4476 W), where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.
2. For fans 6 bhp (4476 W) and larger, where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.
3. For fans used only in *approved* life safety applications such as smoke evacuation.
4. Fans with motor nameplate horsepower less than 1 hp or fans with a fan motor nameplate electrical input power of less than 0.89 kW.
5. Fans equipped with electronic speed control devices to vary the fan airflow as a function of load.

C403.8.3 Fan efficiency. Each fan and *fan array* shall have a *fan energy index (FEI)* of not less than 1.00 at the design point of operation, as determined in accordance with AMCA 208 by an *approved*, independent testing laboratory and labeled by the manufacturer. Each fan and *fan array* used for a variable-air volume system shall have an *FEI* of not less than 0.95 at the design point of operation as determined in accordance with AMCA 208 by an *approved*, independent testing laboratory and labeled by the manufacturer. The *FEI* for *fan arrays* shall be calculated in accordance with AMCA 208 Annex C.

EXCEPTION: The following fans are not required to have a fan energy index:

1. Fans that are not *embedded* ((~~*pans*~~)) fans with motor nameplate horsepower of less than 1.0 hp (0.75 kW) or with a nameplate electrical input power of less than 0.89 kW.
2. *Embedded fans* that have a motor nameplate horsepower of 5 hp (3.7 kW) or less or with a fan system electrical input power of 4.1 kW or less.

3. Multiple fans operated in series or parallel as the functional equivalent of a single fan that have a combined motor nameplate horsepower of 5 hp (3.7 kW) or less or with a fan system electrical input power of 4.1 kW or less.
4. Fans that are part of equipment covered under Section C403.3.2.
5. Fans included in an equipment package certified by an *approved agency* for air or energy performance.
6. *Ceiling fans*.
7. Fans used for moving gases at temperatures above 425°F (250°C).
8. Fans used for operation in explosive atmospheres.
9. Reversible fans used for tunnel ventilation.
10. Fans that are intended to operate only during emergency conditions.
11. Fans outside the scope of AMCA 208.

C403.8.4 Low-capacity ventilation fans. Mechanical ventilation system fans with motors less than 1/12 hp (0.062 kW) in capacity shall meet the efficacy requirements of Table C403.8.4 ((~~at one or more rating points~~)). Airflow shall be tested in accordance with the test procedure referenced in Table C403.8.4 and listed. The efficacy, airflow divided by power, shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. The efficacy shall be determined using the input power at a listed airflow that is not less than the design airflow or shall be determined by interpolating between the input power at the two nearest listed airflow rates. Design airflow, power, and efficacy shall be reported on the mechanical equipment schedule submitted in the permit documents.

EXCEPTIONS:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators and domestic range booster fans that operate intermittently.
3. Fans in radon mitigation systems.
4. Fans not covered within the scope of the test methods referenced in Table C403.8.5.
5. Ceiling fans regulated under 10 CFR 430 Appendix U.
6. Mechanical ventilation system types with an input power greater than 62 watts having electronically commutated motors or motors with a minimum efficiency of 70 percent when rated in accordance with DOE 10 CFR 431. Such systems shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustment for airflow balancing in lieu of a varying motor speed. The efficiency shall be verified through certification under an approved certification program, or, where no certification program exists, the equipment efficiency rating shall be supported by data furnished by the motor manufacturer.

The efficacy shall be determined at a listed airflow that is not less than the design airflow or shall be determined by interpolating between the efficacies determined at the two nearest listed airflow rates.

((~~**Table C403.8.4**~~
~~**Low-Capacity Ventilation Fan Efficacy**~~[a]

~~Fan Location~~	~~Airflow Rate Minimum (cfm)~~	~~Minimum Efficacy (cfm/watt)~~	~~Airflow Rate Maximum (cfm)~~
~~HRV or ERV~~	~~Any~~	~~1.2 cfm/watt~~	~~Any~~
~~Range hood~~	~~Any~~	~~2.8 cfm/watt~~	~~Any~~
~~In-line fan~~	~~Any~~	~~3.8 cfm/watt~~	~~Any~~
~~Bathroom, utility room~~	~~10~~	~~2.8 cfm/watt~~	~~< 90~~
~~Bathroom, utility room~~	~~90~~	~~3.5 cfm/watt~~	~~Any~~

~~For SI: 1 cfm/ft = 47.82 W.~~

~~a. Airflow shall be tested in accordance with HVI 916 and listed. Efficacy shall be listed or shall be derived from listed power and airflow. Fan efficacy for fully ducted HRV, ERV, balanced and in-line fans shall be determined at a static pressure not less than 0.2 inch w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be determined at a static pressure not less than 0.1 inch w.c.~~))

Table C403.8.4
Low-Capacity Ventilation Fan Efficacy[a]

System Type	Airflow Rate (cfm)	Minimum Efficacy (cfm/watt)	Minimum Static Pressure for Testing	Test Procedure
Balanced ventilation system without heat or energy recovery	Any	1.2[a]	0.2 inch w.c.	ASHRAE Standard 51 (ANSI/AMCA Standard 210)
HRV or ERV	Any	1.2[a]	0.2 inch w.c.[b]	CAN/CSA 439-18
Range hood	Any	2.8	0.1 inch w.c.	ASHRAE 51 (ANSI/AMCA Standard 210)
In-line supply or exhaust fan	Any	3.8	0.2 inch w.c.	
Other exhaust fan	≤90	2.8	0.1 inch w.c.	
	>90 and <200	3.5	0.1 inch w.c.	
	≥200	4.0	0.1 inch w.c.	

For SI: 1 cfm/ft = 47.82 W.

a. For balanced systems, HRVs, and ERVs, the efficacy shall be determined as the outdoor airflow divided by the total fan power of the system.

b. The minimum static pressure for determining HRV or ERV fan efficacy shall be 0.4 inch w.c. for airflows greater than or equal to 100 L/s.

C403.8.5 Fan controls. Controls shall be provided for fans in accordance with Section C403.8.5.1 and as required for specific systems provided in Section C403.

C403.8.5.1 Fan airflow control. Each cooling system listed in Table C403.8.5.1 shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1. Direct expansion (DX) and chilled water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have not fewer than two stages of fan control. Low or minimum speed shall not be greater than 66 percent of full speed. At low or minimum speed, the fan system shall draw not more than 40 percent of the fan power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.
2. Other units including DX cooling units and chilled water units that control the space temperature by modulating the airflow to the space shall have modulating fan control. Minimum speed shall be not greater than 50 percent of full speed. At minimum speed, the fan system shall draw no more than 30 percent of the power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.
3. Units that include an airside economizer in accordance with Section C403.5 shall have not fewer than two speeds of fan control during economizer operation.

EXCEPTIONS:

1. Modulating fan control is not required for chilled water and evaporative cooling units with fan motors of less than 1 hp (0.746 kW) where the units are not used to provide ventilation air and the indoor fan cycles with the load.
2. Where the volume of outdoor air required to comply with the ventilation requirements of the *International Mechanical Code* at low speed exceeds the air that would be delivered at the minimum speed defined in Section C403.8.5, the minimum speed shall be selected to provide the required ventilation air.

Table C403.8.5.1
Fan Control

Cooling System Type	Fan Motor Size	Mechanical Cooling Capacity
DX cooling	Any	≥ 42,000 Btu/h
Chilled water and evaporative cooling	≥ 1/4 hp	Any

C403.8.6 Large-diameter ceiling fans. Where provided, *large-diameter ceiling fans* shall be tested and labeled in accordance with AMCA 230.

C403.9 Heat rejection and heat recovery equipment.

C403.9.1 Heat rejection equipment. Heat rejection equipment, including air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers and evaporative condensers, shall comply with this section.

EXCEPTION: Heat rejection devices where energy usage is included in the equipment efficiency ratings listed in Tables C403.3.2(1), C403.3.2(2), C403.3.2(3), C403.3.2(4), C403.3.2(8), C403.3.2(9), C403.3.2(10) and C403.3.2(16).

Heat rejection equipment shall have a minimum efficiency performance not less than values specified in Table C403.3.2(7).

C403.9.1.1 Fan speed control. Each fan powered by an individual motor or array of motors with a connected power, including the motor and devices configured to automatically modulate the fan speed to control the leaving fluid temperature or condensing temperature and pressure of the heat rejection device. Fan motor power input shall be not more than 30 percent of design wattage at 50 percent of the design airflow.

EXCEPTIONS:

1. Fans serving multiple refrigerant or fluid cooling circuits.
2. Condenser fans serving flooded condensers.

C403.9.1.2 Multiple-cell heat rejection equipment. Multiple-cell heat rejection equipment with variable speed fan drives shall be controlled to operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components and so that all fans can operate at the same fan speed required for the instantaneous cooling duty, as opposed to staged (on/off) operation. The minimum fan speed shall be the minimum allowable speed of the fan drive system in accordance with the manufacturer's recommendations.

C403.9.1.3 Limitation on centrifugal fan open-circuit cooling towers. Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1,100 gpm (4164 L/m) or greater at 95°F (35°C) condenser water return, 85°F (29°C) condenser water supply, and 75°F (24°C) outdoor air wet-bulb temperature shall meet the energy efficiency requirement for axial fan open-circuit cooling towers listed in Table C403.3.2(7).

C403.9.1.4 Tower flow turndown. Open-circuit cooling towers used on water-cooled chiller systems that are configured with multiple- or variable-speed condenser water pumps shall be designed so that all open circuit cooling tower cells can be run in parallel with the larger of the flow that is produced by the smallest pump at its minimum expected flow rate or at 50 percent of the design flow for the cell.

C403.9.2 Heat recovery.

C403.9.2.1 Condenser heat recovery for service water heating. Condenser heat recovery shall be installed for heating or reheating of service hot water provided the facility operates 24 hours a day, the total installed heat capacity of water cooled systems exceeds 1,500,000 Btu/hr of heat rejection, and the design service water heating load exceeds 250,000 Btu/hr.

The required heat recovery system shall have the capacity to provide the smaller of:

1. Sixty percent of the peak heat rejection load at design conditions; or
2. The preheating required to raise the peak service hot water draw to 85°F (29°C).

EXCEPTIONS:

1. Facilities that employ condenser heat recovery for space heating or reheat purposes with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
2. Facilities that provide 60 percent of their service water heating from site recovered energy.

C403.9.2.2 Steam condensate systems. On-site steam heating systems shall have condensate water ((~~heat~~)) recovery. On-site includes a system that is located within or adjacent to one or more buildings within the boundary of a contiguous area or campus under one ownership and which serves one or more of those buildings.

Buildings using off-site generated steam where the condensate is not returned to the source, shall have an on-site condensate water heat recovery system.

C403.9.2.3 Refrigeration condenser heat recovery. Facilities having food service, meat or deli departments and having 500,000 Btu/h or greater of remote refrigeration condensers shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, space heating or for dehumidification reheat. Facilities having a gross conditioned floor area of 40,000 ft^2 or greater and 1,000,000 Btu/h or greater of remote refrigeration shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, and either for space heating or for dehumidification reheat for maintaining low space humidity.

C403.9.2.4 Condenser heat recovery for space heating. A water-source condenser heat recovery system meeting the requirements of Sections C403.9.2.4.1 through C403.9.2.4.4 shall be installed to serve space and ventilation heating systems in new buildings and additions meeting the following criteria:

1. The facility operates greater than 70 hours per week.
2. The sum of all heat rejection equipment capacity serving the new building or addition exceeds 1,500,000 Btu/hr.
3. The sum of zone minimum airflows in all zones with zone reheat coils divided by the conditioned floor area served by those systems is at least 0.45 cfm per square foot.

EXCEPTION: Systems complying with Section C403.3.5, Dedicated outdoor air systems.

C403.10.1.2 Other supply and return ducts. All other supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces, and where located outside the building with a minimum of R-8 insulation in Climate Zone 4 and R-12 insulation in Climate Zone 5. Ducts located underground beneath buildings shall be insulated as required in this section or have an equivalent *thermal distribution efficiency*. Underground ducts utilizing the *thermal distribution efficiency* method shall be listed and labeled to indicate the *R*-value equivalency. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by minimum insulation value as required for exterior walls by Section C402.1.3.

EXCEPTIONS:

1. Where located within equipment.
2. Supply and return ductwork located in unconditioned spaces where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C) and are insulated in accordance with Table C403.10.1.2.

Where located within conditioned space, supply ducts which convey supply air at temperatures less than 55°F or greater than 105°F shall be insulated with a minimum insulation *R*-value in accordance with Table C403.10.1.2.

EXCEPTION: Ductwork exposed to view within a zone that serves that zone is not required to be insulated.

Where located within conditioned space, return or exhaust air ducts that convey return or exhaust air downstream of an energy recovery media shall be insulated with a minimum insulation *R*-value in accordance with Table C403.10.1.2.

Where located within conditioned space, ducts that convey air from outside the conditioned space shall be insulated with a minimum insulation R-value in accordance with Table C403.10.1.2.

Where located within conditioned space, ducts that convey ambient air to and from outside for the condenser section of HVAC heat pumps, service hot water heat pumps, or air conditioning units shall be insulated with a minimum insulation R-value in accordance with Table C403.10.1.2.

All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Table C403.10.1.2
Supply, Return, Exhaust and Relief Air Ductwork Insulation

Duct System	Duct Location and Use	Climate Zone	Minimum Installed Duct Insulation *R*-value[a,b]	Notes
Supply air or return air	Outside the building (outdoors and exposed to weather)[c]	4C	R-8	See Section C403.10.1.2 for details
Supply air or return air	Outside the building (outdoors and exposed to weather)[c]	5B	R-12	See Section C403.10.1.2 for details
Supply air or return air	Unconditioned space (enclosed but not in the building conditioned envelope)	4C and 5B	R-6	See Section C403.10.1.2 for details
Supply air or return air	Unconditioned space where the duct conveys air that is within 15°F of the air temperature of the surrounding unconditioned space	4C and 5B	R-3.3	See IMC Section 603.12 for additional requirements for condensation control at ductwork
Supply air or return air	Where located in a building envelope assembly	4C and 5B	R-16	Duct or plenum is separated from building envelope assembly with the minimum insulation value
Supply air	Within conditioned space where the supply duct conveys air that is less than 55°F or greater than 105°F	4C and 5B	R-3.3	See Section C403.10.1.2 for details
Supply air	Within conditioned space that the duct directly serves where the supply duct conveys air that is less than 55°F or greater than 105°F	4C and 5B	None	See Section C403.10.1.2 for details
Supply air	Within conditioned space where the supply duct conveys air that is 55°F or greater and 105°F or less	4C and 5B	None	
Return or exhaust air	Within conditioned space, downstream of an energy recovery media, upstream of an automatic shutoff damper	4C	R-8	

Table C403.10.1.2—continued
Supply, Return, Exhaust and Relief Air Ductwork Insulation

Duct System	Duct Location and Use	Climate Zone	Minimum Installed Duct Insulation *R*-value[a,b]	Notes
Return or exhaust air	Within conditioned space, downstream of an energy recovery media, upstream of an automatic shutoff damper	5B	R-12	
Relief or exhaust air	Conditioned space and downstream of an automatic shutoff damper	4C and 5B	R-16	
Exhaust or other air duct	Duct conveying air from unconditioned space through conditioned space	4C and 5B	R-16	
Condenser air intake and outlet	Conditioned space and conveys ambient air to or from the outdoors to heat pump or AC unit condenser	4C and 5B	< 2800 CFM = R-8 ≥ 2800 CFM = R-16	

a Insulation R-values, measured in h•ft²•°F/Btu, are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F at the installed thickness.

b See *International Mechanical Code* Sections 603.12 and 604 for further details on duct insulation requirements.

c Includes attics above insulated ceilings, parking garages and crawl spaces.

C403.10.2 Duct construction. Ductwork shall be constructed and erected in accordance with the *International Mechanical Code*. For the purposes of this section, longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw, fastener, pipe, rod, or wire. All other connections are considered transverse joints including, but not limited to, spin-ins, taps, and other branch connections, access door frames and jambs, and duct connections to equipment. Ducts shall be leak-tested where required by Section C403.10.2.4.

C403.10.2.1 Low-pressure duct systems. Longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus embedded-fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

EXCEPTION: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.

C403.10.2.2 Medium-pressure duct systems. Ducts and plenums designed to operate at a static pressure greater than 2 inches water gauge (w.g.) (500 Pa) but less than 3 inches w.g. (750 Pa) shall be insulated and sealed in accordance with Section C403.10.1. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

C403.10.2.3 High-pressure duct systems. Ducts designed to operate at static pressures equal to or greater than 3 inches water gauge (w.g.) (750 Pa) shall be insulated and sealed in accordance with Section C403.10.1.

C403.10.2.4 Duct leak testing. ((~~In addition, ducts~~)) Ducts and plenums designed to operate at static pressures equal to or greater than 3 inches water gauge (w.g.) (750 Pa) and all supply and return ductwork that is located outside the *building thermal envelope* and that serves *conditioned space*, regardless of the Design Construction Pressure Class level, shall be leak-tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual* and shown to have a rate of air leakage (*CL*) less than or equal to 4.0, as determined in accordance with Equation 4-12. Ducts shall be tested using a pressure equal to the average operating pressure or the design Duct Construction Pressure Class level in accordance with the SMACNA HVAC Air Duct Leakage Test Manual.

$$CL = F/P^{0.65} \qquad \textbf{(Equation 4-12)}$$

Where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.

P = The static pressure of the test.

Documentation shall be furnished demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.

C403.10.3 Piping insulation. All piping, other than field installed HVAC system refrigerant piping, serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.10.3.

C403.11 Mechanical systems located outside of the building thermal envelope. Mechanical systems providing heat outside of the thermal envelope of a building shall be configured to comply with Section C403.11.1 through C403.11.3, and shall be provided with an electric heat pump or electric resistance heating system in accordance with Section C403.1.4.

C403.11.1 Heating outside a building or in unheated spaces. Systems installed to provide heat outside a building or in unheated spaces shall be radiant systems.

Such heating systems shall be controlled by an occupancy sensing device or a timer switch, so that the system is automatically deenergized when no occupants are present in the area heated by each individual device for a period not to exceed 20 minutes.

C403.11.2 Snow- and ice-melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include *automatic* controls configured to shut off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an *automatic* control that is configured to shut off when the outdoor temperature is above 40°F (4°C) so that the potential for snow or ice accumulation is negligible.

C403.11.3 Freeze protection system controls. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include *automatic* controls configured to shut off the systems when outdoor air temperatures are above 40°F (4°C) or when the conditions of the protected fluid will prevent freezing.

C403.12 High efficiency single-zone variable air volume (VAV) systems.

1. The single-zone VAV system is provided with airside economizer in accordance with Section C403.3 without exceptions.
2. A direct-digital control (DDC) system is provided to control the system as a single zone in accordance with Section C403.4.11 regardless of sizing thresholds of Table C403.4.11.1.
3. Single-zone VAV systems with a minimum outdoor air requirement of 1,000 cfm (472 L/s) or greater shall be equipped with a device capable of measuring outdoor airflow intake under all load conditions. The system shall be capable of increasing or reducing the outdoor airflow intake based on Section C403.7.1, Demand controlled ventilation.
4. Allowable fan power shall not exceed 90 percent of the allowable fan power budget as defined by Section C403.8.1.1.
5. Each single-zone VAV system shall be designed to vary the supply fan airflow as a function of heating and cooling load and minimum fan speed shall not be more than the greater of:
   5.1. 30 percent of peak design airflow; or
   5.2. The required ventilation flow assuming no occupants.
6. Spaces that are larger than 150 square feet (14 m^2) and with an occupant load greater than or equal to 25 people per 1000 square feet (93 m^2) of floor area (as established in Table 403.3.1.1 of the *International Mechanical Code*) shall be provided with all of the following features:
   6.1. Demand control ventilation (DCV) shall be provided that utilizes a carbon dioxide sensor to reset the ventilation setpoint of the single-zone VAV system from the design minimum to design maximum ventilation rate as required by Chapter 4 of the *International Mechanical Code*.
   6.2. Occupancy sensors shall be provided that are configured to reduce the minimum ventilation rate to zero and setback room temperature setpoints by a minimum of 5°F, for both cooling and heating, when the space is unoccupied.
7. Single-zone VAV systems shall comply with one of the following options:
   7.1. Single-zone VAV air handling units with a hydronic heating coil connected to systems with hot water generation equipment limited to the following types of equipment: ((~~Gas-fired hydronic boilers with a thermal efficiency, E_t, of not less than 92 percent,~~)) air-to-water heat pumps or heat recovery chillers. Hydronic heating coils shall be sized for a maximum entering hot water temperature of 120°F for peak anticipated heating load conditions.
   7.2. Single-zone VAV air handing units with a chilled water coil connected to systems with chilled water generation equipment with IPLV values more than 25 percent higher than the minimum part load efficiencies listed in Table C403.3.2(3), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify. The smallest chiller or compressor in the central plant shall not exceed 20 percent of the total central plant cooling capacity or the chilled water system shall include thermal storage sized for a minimum of 20 percent of the total central cooling plant capacity.
   7.3. Single-zone VAV air handling units with DX cooling, heat pump heating or gas-fired furnace shall comply with the following requirements as applicable:
      7.3.1. Have a DX cooling coil with cooling part load efficiency that is a minimum of 15 percent higher than the minimum SEER or IEER listed in Tables C403.3.2(1), C403.3.2(2), and C403.3.2 (14).

7.3.2. Have a gas-fired furnace with a thermal efficiency, E_t, of not less than 90 percent or heat pump with a minimum heating HSPF or COP efficiency that are a minimum of 10 percent higher than the minimum heating efficiency in Tables C403.3.2(1), C403.3.2(2), and C403.3.2(14).

7.3.3. Heating coils or burner output shall be modulating or have a minimum of 2 stages with the first stage being less than 50 percent of total heating capacity. Cooling coils shall be modulating or have a minimum of 2 stages with the first stage being less than 50 percent of the total cooling capacity.

8. The DDC system shall include a fault detection and diagnostics (FDD) system complying with the following:

8.1. The following temperature sensors shall be permanently installed to monitor system operation:

8.1.1. Outside air.

8.1.2. Supply air.

8.1.3. Return air.

8.2. Temperature sensors shall have an accuracy of ±2°F (1.1°C) over the range of 40°F to 80°F (4°C to 26.7°C).

8.3. The single-zone VAV air handling unit controller shall be configured to provide system status by indicating the following:

8.3.1. Free cooling available.

8.3.2. Economizer enabled.

8.3.3. Compressor enabled.

8.3.4. Heating enabled.

8.3.5. Mixed air low limit cycle active.

8.3.6. The current value of each sensor.

8.4. The single-zone VAV air handling unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and the heating system can be independently tested and verified.

8.5. The single-zone VAV air handling unit shall be configured to report faults to a fault management application able to be accessed by day-to-day operating or service personnel or annunciated locally on zone thermostats.

8.6. The FDD system shall be configured to detect the following faults:

8.6.1. Air temperature sensor failure/fault.

8.6.2. Not economizing when the unit should be economizing.

8.6.3. Economizing when the unit should not be economizing.

8.6.4. Outdoor air or return air damper not modulating.

8.6.5. Excess outdoor air.

C403.13 Dehumidification in spaces for plant growth and maintenance. Equipment that dehumidifies building spaces used for plant growth and maintenance shall be one of the following:

1. *Stand-alone dehumidifiers* that meet the following minimum integrated energy factors as measured by the test conditions in Appendix X1 to Subpart B of 10 C.F.R. Part 430:

1.1. Minimum integrated energy factor of 1.77 L/kWh for product case volumes of 8.0 cubic feet or less;

1.2. Minimum integrated energy factor of 2.41 L/kWh for product case volumes greater than 8.0 cubic feet;

2. *Integrated HVAC system* including, but not limited to, heat pump technology, with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat;

3. Chilled water system including, but not limited to, heat pump technology, with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat; or

4. Solid or liquid *desiccant dehumidification system* for system designs that require dewpoint of 50°F (10°C) or less.

C403.14 Commissioning. Mechanical systems shall be commissioned in accordance with Section C408.

SECTION C404
SERVICE WATER HEATING AND PRESSURE-BOOSTER SYSTEMS

C404.1 General. This section covers the minimum efficiency of, and controls for, service water-heating equipment and insulation of service hot water piping.

EXCEPTION: Energy using equipment used by a manufacturing, industrial or commercial process other than maintaining comfort and amenities for the occupants are exempt from all Section C404 subsections except Sections C404.2, C404.6 and C404.13. Laboratory sinks are considered to be process equipment for the purposes of this exception.

C404.2 Service water-heating equipment performance efficiency. Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through certification and *listed* under an *approved* certification program, or if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Water-heating equipment intended to be used to provide space heating shall meet the applicable provisions of Table C404.2.

C404.2.1 Service water heating system type. Service hot water shall be provided by an electric air-source heat pump water heating (HPWH) system, or a ground-source heat pump water heating (GSHP) system. meeting the requirements of this section. Supplemental service water heating equipment is permitted to use electric resistance ((~~or fossil fuel~~)) in compliance with Section C404.2.1.4.

EXCEPTIONS:

1. 24 kW plus 0.1 watts per square foot of building area of electric resistance service water heating capacity is allowed per building.
2. Solar thermal, wastewater heat recovery, other *approved* waste heat recovery, ((~~ground-source heat pumps,~~)) water-source heat pump systems utilizing waste heat, and combinations thereof, are permitted to offset all or any portion of the required HPWH capacity where such systems comply with this code and the *Uniform Plumbing Code*, and are not claimed in Section C406.2.5, C407, or C411.
3. Systems that comply with the Northwest Energy Efficiency Alliance (NEEA) Commercial Electric Advanced Water Heating Specification.

SDCI Informative Note: To view the NEEA Advanced Water Heating Specification (AWHS) for central service water heating systems, see AWHS v8.0 (http://www.neea.org).

4. Service hot water systems served by a district energy system that serves multiple buildings and that was in service before the effective date of this code, including more energy-efficient upgrades to such existing systems, are permitted to serve as the primary heating energy source.
5. Commercial dishwashers, commercial food service equipment, and other *approved* process equipment are permitted to utilize electric booster heaters for supply water temperatures 120°F (49°C) or higher.
6. Systems connected to a *low-carbon district energy exchange system* or a *low-carbon district heating and cooling or heating only system*.
7. Essential facilities. Groups I-2 and I-3 occupancies that by regulation are required to have in place redundant emergency backup systems are permitted to use electric resistance or fossil fuel combustion equipment for those emergency backup systems.
8. Point of use instantaneous electric water heaters, serving fixtures no more than 8 feet of developed pipe length from the water heater, are permitted and do not contribute to the building combined water heating capacity calculation.
9. For other than Group R and Group I occupancies, unitary electric air-source heat pump water heaters are permitted to extract heat from the conditioned space where the primary source of space heating is electric heat pump or where heat recovery of waste heat is available, and where they are sized to meet all calculated service water heating demand using the heat pump compressor, and not supplementary heat.

SDCI Informative Note: For the purposes of this exception, "heat recovery of waste heat" can utilize heat from commercial cooking appliances, freezers, refrigerators, electronic equipment, machine rooms, and other internal heat sources. Such heat production must have sufficient magnitude and consistency to provide the majority of the heat energy required by operation of the heat pump water heater.

10. Standby service water heating equipment provided in addition to the primary heating system, and controlled such that it will only be used when the primary heating equipment is not available, is permitted to be electric resistance.

C404.2.1.1 Primary heat pump system sizing. The primary heat pump service water heating system shall be sized to deliver no less than ((~~50~~)) 100 percent of the calculated demand for service hot water production during the peak demand period. Demand shall be calculated using the equipment manufacturer's selection criteria or another *approved* methodology with entering dry bulb or wet bulb outdoor air temperature at 40°F (4°C) for air source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps. Electric air source heat pumps shall also be sized to deliver no

less than ((~~25~~)) 50 percent of the calculated demand for service hot water production during the peak demand period when entering dry bulb or wet bulb outdoor air temperature is 24°F (-4°C). The remaining primary service output may be met by ((~~fossil fuel,~~)) electric resistance, or heat pump water heating systems.

EXCEPTIONS:

1. ((~~Twenty five~~)) Fifty percent sizing at entering dry bulb or wet bulb air temperature of 24°F (-4°C) is not required for air-source heat pumps located in a below-grade enclosed parking structure or other ventilated and unconditioned space that is not anticipated to fall below 40°F (4°C) at any time.
2. Any of the following system types are permitted to replace all or part of the primary heat pump service water heating system capacity:
    a. Wastewater heat recovery systems that recover heat from wastewater of both cold and hot water plumbing fixtures and that utilize electric water-source heat pumps. The heat pumps shall be sized for incoming wastewater temperatures of no higher than 70°F (21°C) for Group R and Group I occupancies, and no higher than 60°F (16°C) for all other occupancies, unless an alternate wastewater temperature is *approved* by the code official.
    b. Solar thermal systems.
    c. Other electric water-source heat pump systems that utilize waste heat recovered from year-round mechanical cooling loads or other *approved* sources.

C404.2.1.2 Primary hot water storage sizing. The system shall provide sufficient hot water, as calculated using an *approved* methodology, to satisfy peak demand period requirements.

C404.2.1.3 System design. The service water heating system shall be configured to conform to one of the following provisions:

1. For *single-pass heat pump water heaters*, *temperature maintenance* heating provided for reheating return water from the building's heated water circulation system shall be physically decoupled from the primary service water heating system storage tank(s) in a manner that prevents destratification of the primary system storage tanks. *Temperature maintenance* heating is permitted to be provided by electric resistance, fossil fuel, or a separate dedicated heat pump system.
2. For *multi-pass heat pump water heaters*, *recirculated temperature* maintenance water is permitted to be returned to the primary water storage tanks for reheating.
3. ((~~For unitary~~)) Unitary heat pump water heaters, located in conditioned space, are permitted, where they are sized to meet all calculated service water heating demand using the heat pump compressor, and not supplementary heat.

C404.2.1.3.1 Mixing valve. A thermostatic or electronic mixing valve capable of supplying hot water to the building at the user temperature setpoint shall be provided, in compliance with requirements of the ((~~*Uniform*~~)) Seattle *Plumbing Code* and the HPWH manufacturer's installation guidelines. The mixing valve shall be sized and rated to deliver tempered water in a range from the minimum flow of the *temperature maintenance* recirculation system up to the maximum demand for the fixtures served.

C404.2.1.4 Supplemental water heating. Total supplemental water heating equipment shall not have an output capacity greater than the total summed capacity of all primary water heating equipment. For the purposes of determining this supplemental water heating allowance, the capacity of primary water heating equipment shall be evaluated at 40°F (4°C) entering dry bulb or wet bulb outdoor air temperature for air-source heat pumps, 44°F (7°C) ground temperature for ground-source heat pumps, and at the nameplate input rate for all other water heater system types. Supplemental heating is permitted for the following uses:

1. Temperature maintenance of heated-water circulation systems, physically separate from the primary service water heating system.
2. Defrost of compressor coils.
3. Heat tracing of piping for freeze protection or for temperature maintenance in lieu of recirculation of hot water.
4. Backup or low ambient temperature conditions, where all of the following are true:
    4.1. During normal operations, the supplemental heating is controlled to operate only when the entering air temperature at the air-source HPWH is below 40°F (4°C), and the primary HPWH compressor continues to operate together with the supplemental heating.
    4.2. The primary water heating equipment cannot satisfy the system load due to equipment failure or entering air temperature below 40°F (4°C).

C404.2.1.5 System fault detection. The control system shall be capable of and configured to send automatic error alarms to building or maintenance personnel upon detection of equipment faults, low leaving water temperature from primary storage tanks, or low hot water supply delivery temperature to building distribution system.

Table C404.2
Minimum Performance of Water-Heating Equipment

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Draw Pattern	Performance Required[a,j]	Test Procedure[b]
Electric table-top water heaters[k]	≤ 12 kW[c]	≥ 20 gal ≤ 120 gal	Very small Low Medium High	UEF ≥ 0.6323 - (0.0058 × Vr) UEF ≥ 0.9188 - (0.0031 × Vr) UEF ≥ 0.9577 - (0.0023 × Vr) UEF ≥ 0.9884 - (0.0016 × Vr)	DOE 10 C.F.R. Part 430 App. E
Electric storage water heaters[g,i] resistance and heat pump	≤ 12 kW[c]	≥ 20 gal ≤ 55 gal	Very small Low Medium High	UEF ≥ 0.8808 - (0.0008 × Vr) UEF ≥ 0.9254 - (0.0003 × Vr) UEF ≥ 0.9307 - (0.0002 × Vr) UEF ≥ 0.9349 - (0.0001 × Vr)	DOE 10 C.F.R. Part 430 App. E
	≤ 12 kW	> 55 gal ≤ 120 gal	Very small Low Medium High	UEF ≥ 1.9236 - (0.0011 × Vr) UEF ≥ 2.0440 - (0.0011 × Vr) UEF ≥ 2.1171 - (0.0011 × Vr) UEF ≥ 2.2418 - (0.0011 × Vr)	DOE 10 C.F.R. Part 430 App. E
Electric storage water heaters[g]	> 12 kW			(0.3 + 27/Vm), %h	DOE 10 C.F.R. 431.106 App B.
Grid-enabled water heaters[g,l]		> 75 gal	Very small Low Medium High	UEF ≥ 1.0136 - (0.0028 × Vr) UEF ≥ 0.9984 - (0.0014 × Vr) UEF ≥ 0.9853 - (0.0010 × Vr) UEF ≥ 0.9720 - (0.0007 × Vr)	10 C.F.R. 430 Appendix E
Electric instantaneous water heater[h]	≤ 12 kW	< 2 gal	Very small Low Medium High	UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.92	DOE 10 C.F.R. Part 430
	> 12 kW & ≤ 58.6 kW[c]	≤ 2 gal ≤ 180°F	All	UEF ≥ 0.80	DOE 10 C.F.R. Part 430
Gas storage water heaters[g]	≤ 75,000 Btu/h	≥ 20 gal & ≤ 55 gal[f]	Very small Low Medium High	UEF ≥ 0.3456 - (0.0020 × Vr) UEF ≥ 0.5982 - (0.0019 × Vr) UEF ≥ 0.6483 - (0.0017 × Vr) UEF ≥ 0.6920 - (0.0013 × Vr)	DOE 10 C.F.R. Part 430 App. E
	≤ 75,000 Btu/h	> 55 gal & ≤ 100 gal[f]	Very small Low Medium High	UEF ≥ 0.6470 - (0.0006 × Vr) UEF ≥ 0.7689 - (0.0005 × Vr) UEF ≥ 0.7897 - (0.0004 × Vr) UEF ≥ 0.8072 - (0.0003 × Vr)	DOE 10 C.F.R. Part 430 App. E
	> 75,000 Btu/h and ≤ 105,000 Btu/h[d]	≤ 120 gal ≤ 180°F	Very small Low Medium High	UEF ≥ 0.2674-0.0009 x Vr UEF ≥ 0.5362-0.0012 x Vr UEF ≥ 0.6002-0.0011 x Vr UEF ≥ 0.6597-0.0009 x Vr	DOE 10 C.F.R. Part 430 App. E
	> 105,000 Btu/h[d,f]			80% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 C.F.R. 431.106
Gas instantaneous water heater[h]	> 50,000 Btu/h and < 200,000 Btu/h	< 2 gal	Very small Low Medium High	UEF ≥ 0.80 UEF ≥ 0.81 UEF ≥ 0.81 UEF ≥ 0.81	DOE 10 C.F.R. Part 430 App. E
	≥ 200,000 Btu/h[d,f]	< 10 gal		80% E_t	DOE 10 C.F.R. 431.106
	≥ 200,000 Btu/h[f]	≥ 10 gal		80% E_t SL ≤ (Q/800 +110√V), Btu/h	

Table C404.2—continued
Minimum Performance of Water-Heating Equipment

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Draw Pattern	Performance Required[a,j]	Test Procedure[b]
Oil storage water heaters[g]	≤ 105,000 Btu/h	≤ 50 gal	Very small Low Medium High	UEF = 0.2509 - (0.0012 × Vr) UEF = 0.5330 - (0.0016 × Vr) UEF = 0.6078 - (0.0016 × Vr) UEF = 0.6815 - (0.0014 × Vr)	DOE 10 C.F.R. Part 430
	> 105,000 Btu/h and ≤ 140,000 Btu/h[e]	≤ 120 gal ≤ 180°F	Very small Low Medium High	UEF ≥ 0.2932-0.0015 x Vr UEF ≥ 0.5596-0.0018 x Vr UEF ≥ 0.6194-0.0016 x Vr UEF ≥ 0.6740-0.0013 x Vr	DOE 10 C.F.R. Part 430 App. E
	> 140,000 Btu/h			80% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 C.F.R. 431.106
Oil instantaneous water heater[h]	≤ 210,000 Btu/h	< 2 gal		80% E_t EF ≥ 0.59 - 0.0005 x V	DOE 10 C.F.R. Part 430 App. E
	> 210,000 Btu/h	< 10 gal		80% E_t	DOE 10 C.F.R. 431.106
	> 210,000 Btu/h	≥ 10 gal		78% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 C.F.R. 431.106
Hot water supply boilers, gas and oil[h]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	< 10 gal		80% E_t	DOE 10 C.F.R. 431.106
Hot water supply boilers, gas[h]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal		80% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 C.F.R. 431.106
Hot water supply boilers, oil[h]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal		78% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 C.F.R. 431.106
Pool heaters, gas	All			82% E_t	DOE 10 C.F.R. Part 430 App. P
Heat pump pool heaters	All	50°F db 44.2°F wb outdoor air 80.0°F entering water		4.0 COP	DOE 10 C.F.R. Part 430 App. P
Unfired storage tanks[m]	All			Minimum insulation requirement R-12.5 (h-ft^2-°F)/Btu	(none)

a Thermal efficiency (E_t) is a minimum requirement, while standby loss is a maximum requirement. In the standby loss equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h. V_m is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term "S," and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term "SL" Draw pattern (DP) refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, V_r refers to the rated volume in gallons.

b Chapter 6 contains a complete specification, including the year version, of the referenced test procedure.

c Electric instantaneous water heaters with input capacity ≤ 12 kW and ≤ 58.6 kW that have either (1) a storage volume ≤ 2 gal; or (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power has no efficiency standard.

d Gas storage water heaters with input capacity ≤ 75,000 Btu/h and ≤ 105,000 Btu/h must comply with the requirements for the ≤ 105,000 Btu/h if the water heater either (1) has a storage volume ≤ 120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

e Oil storage water heaters with input capacity ≤ 105,000 Btu/h and ≤ 140,000 Btu/h must comply with the requirements for the ≤ 140,000 Btu/h if the water heater either (1) has a storage volume ≤ 120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

f Water heaters or gas pool heaters in this category are regulated as consumer products by the USDOE as defined in 10 C.F.R. Part 430.

g Storage water heaters have a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.

h Instantaneous water heaters and hot water supply boilers have an input capacity (Btu/h) divided by storage volume (gal) ≥ 4000 Btu/h-gal.

i There are no minimum efficiency requirements for electric heat pump water heaters greater than 12 kW or for gas heat pump water heaters.

j Refer to Section C404.2.1 for additional requirements for service water heat system equipment.

k A tabletop water heater is a storage water heater that is enclosed in a rectangular cabinet with a flat top surface not more than three feet (0.91 m) in height and have a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.

l A grid-enabled water heater is an electric resistance water heater that meets all of the following:

1. Has a rated storage tank volume of more than 75 gallons.
2. Is manufactured on or after April 16, 2015.
3. Is equipped at the point of manufacture with an activation lock.
4. Bears a permanent label applied by the manufacturer that complies with all of the following:
   4.1. Is made of material not adversely affected by water.

4.2. Is attached by means of nonwater soluble adhesive.

4.3. Advises purchasers and end-users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: "IMPORTANT INFORMATION: This water heater is intended only for use as a part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this "Public

m Unfired storage tanks shall be insulated with additional insulation beyond the minimum insulation required by Table C404.2, in accordance with Section C404.6.1.

C404.3 Efficient heated water supply piping. Heated water supply piping shall be in accordance with Section C404.3.1 or C404.3.2. The flow rate through 1/4-inch (6.4 mm) piping shall be not greater than 0.5 gpm (1.9 L/m). The flow rate through 5/16-inch (7.9 mm) piping shall be not greater than 1 gpm (3.8 L/m). The flow rate through 3/8-inch (9.5 mm) piping shall be not greater than 1.5 gpm (5.7 L/m). Water heaters, circulating water systems and heat trace temperature maintenance systems shall be considered sources of heated water.

C404.3.1 Maximum allowable pipe length method. The maximum allowable piping length from the nearest source of heater water to the termination of the fixture supply pipe shall be in accordance with the following. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.3.1.

1. For a public lavatory faucet, use the "Public lavatory faucets" column in Table C404.3.1.
2. For all other plumbing fixtures and plumbing appliances, use the "Other fixtures and appliances" column in Table C404.3.1.

Table C404.3.1
Piping Volume and Maximum Piping Lengths

Nominal Pipe Size (inches)	Volume (liquid ounces per foot length)	Maximum Piping Length (feet)	
		Public lavatory faucets	Other fixtures and appliances
1/4	0.33	6	50
5/16	0.5	4	50
3/8	0.75	((~~3~~)) 8	50
1/2	1.5	((~~2~~)) 8	43
5/8	2	((~~1~~)) 8	32
3/4	3	0.5	21
7/8	4	0.5	16
1	5	0.5	13
1-1/4	8	0.5	8
1-1/2	11	0.5	6
2 or larger	18	0.5	4

C404.3.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section C404.3.2.1.

The volume from the nearest source of heated water to the termination of the fixture supply pipe shall be as follows:

1. For a public lavatory faucet: Not more than 2 ounces (0.06 L).
2. For other plumbing fixtures or plumbing appliances; not more than 0.5 gallon (1.89 L).

C404.3.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table C404.3.1 or from Table C404.3.2.1. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Table C404.3.2.1
Internal Volume of Various Water Distribution Tubing

Ounces of Water per Foot of Tube									
Nominal Size (inches)	Copper Type M	Copper Type L	Copper Type K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR	Composite ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
1-1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1-1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

C404.3.3 Demand load for Group R-2 occupancies. Demand load for water supply of dwelling units within Group R-2 occupancies shall be determined using Appendix M of the Seattle Plumbing Code. Piping shall be no more than one pipe size larger than the minimum size permitted when sized for maximum allowable velocity based upon the specified piping material in conjunction with the Appendix M demand load flow rate at any specific node within the water distribution system.

EXCEPTION: Existing buildings are not required to comply with this section if the existing plumbing fixtures have higher flow rates than those listed in Table M102.1 of the Seattle Plumbing Code.

C404.4 Heat traps for hot water storage tanks. Storage tank-type water heaters and hot water storage tanks that have vertical water pipes connecting to the inlet and outlet of the tank shall be provided with integral heat traps at the vertical inlets and outlets or shall have pipe-configured heat traps in the piping connected to those inlets and outlets. Tank inlets and outlets associated with solar water heating system circulation loops shall not be required to have heat traps.

C404.5 Water heater installation. Electric water heaters in unconditioned spaces or on concrete floors shall be placed on an incompressible, insulated surface with a minimum thermal resistance of R-10.

C404.6 Insulation of piping. Piping from a water heater to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table ((~~C403.10.3~~)) C404.6. On both the inlet and outlet piping of a storage water heater or heated water storage tank, the piping to a heat trap or the first 8 feet (2438 mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table ((~~C403.10.3~~)) C404.6 or the heat trace manufacturer's instructions. Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions or Table C404.6, whichever results in thicker insulation. Pipe insulation shall be continuous, including through hangers and supports, such that thermal bridging is prevented, except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation.

EXCEPTION: Tubular pipe insulation shall not be required on the following:

1. The tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance.
2. Valves, pumps, strainers and threaded unions in piping that is 1 inch (25 mm) or less in nominal diameter.
3. Piping from user-controlled shower and bath mixing valves to the water outlets.
4. ((~~Cold water piping of a demand recirculation water system.~~))
5. Tubing from a hot drinking-water heating unit to the water outlet.
6. ((~~Piping at~~)) Vertical pipe riser locations where a vertical support of the piping is installed.
7. ((~~Piping surrounded by building insulation with a thermal resistance (*R* value) of not less than R-3.~~))
8. Hot water piping that is part of the final pipe run to the plumbing fixture and is not part of the heated-water circulation system circulation path is not required to meet the minimum insulation requirements of Section C404.6.

Table C404.6
Required Pipe Insulation Thickness for Service Water Heating

Location	Water Temp	Nominal Pipe or Tube Size					Insulation Conductivity	
		< 1"	1 to < 1-1/2"	1-1/2 to < 4"	4 to < 8"	8" or larger	Conductivity Btu • in./ (h • ft^2 • °F)[b]	Mean Rating Temp, °F
Circulation Loop Piping not in-partition	105 - 140°F	2.0	2.0	2.5	2.5	2.5	0.21 - 0.28	100
	141 - 200°F	2.5	2.5	3.0	3.0	3.0	0.25 - 0.29	125
All other piping not in-partition	105 - 140°F	1.0	1.0	1.5	1.5	1.5	0.21 - 0.28	100
	141 - 200°F	1.5	1.5	2.0	2.0	2.0	0.25 - 0.29	125
In-partition[a] Circulation Loop Piping	105 - 140°F	1.0	1.0	2.5	2.5	2.5	0.21 - 0.28	100
	141 - 200°F	1.5	1.5	3.0	3.0	3.0	0.25 - 0.29	125
In-partition[a] All other piping	105 - 140°F	1.0	1.0	1.5	1.5	1.5	0.21 - 0.28	100
	141 - 200°F	1.5	1.5	2.0	2.0	2.0	0.25 - 0.29	125

a. In a partition within a *conditioned space*.
b. For insulation outside the stated conductivity range, conform to requirements of Table C403.10.1.

C404.6.1 Storage tank insulation. Unfired storage tanks used to store service hot water at temperatures above 130°F (54°C) shall be wrapped with an insulating product, installed in accordance with the insulation manufacturer's instructions and providing a minimum of R-2 additional insulation for every 10°F (5°C) increase in stored water temperature above 130°F (54°C). Such additional insulation is also permitted to be integral to the tank. The insulation is permitted to be discontinuous at structural supports.

C404.7 Heated-water circulating and heat trace temperature maintenance systems. Heated-water circulation systems for *temperature maintenance* shall be in accordance with Section C404.7.1. Electric resistance heat trace systems for *temperature maintenance* shall be in accordance with Section C404.7.2. Controls for hot water storage shall be in accordance with Section C404.7.3. Automatic controls, temperature sensors and pumps shall be in a location with *access*. Manual controls shall be in a location with *ready access*.

C404.7.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The pump shall have an electronically commutated motor with a means of adjusting motor speed for system balancing. The system return pipe shall be a dedicated return pipe. Gravity and thermo-syphon circulation systems are prohibited. Controls shall start the circulation pump based on the identification of a demand for hot water within the occupancy, according to the requirements of Sections C404.7.1.1 and C404.7.1.2.

C404.7.1.1 Single riser systems. Where the circulation system serves only a single domestic hot water riser or zone, the following controls shall be provided:

1. Controls shall be configured to automatically turn off the pump when the water in the circulation loop is at the design supply temperature and shall not turn the pump back on until the temperature is a minimum of 10°F (5°C) lower than the design supply temperature.
2. Controls shall be equipped with a manual switch or other control method that can be used to turn off the circulating pump during extended periods when hot water is not required.

C404.7.1.2 Multiple riser systems. Where the circulation system serves multiple domestic hot water risers or piping zones, the following equipment and controls shall be provided:

1. Controls shall be configured to automatically turn off the circulation pump during ((~~extended~~)) periods of time exceeding 4 hours when hot water is not required. Pump circulation is permitted to be automatically started a maximum of 4 hours before scheduled occupancy time to warm up the system or may be automatically started and stopped to run a maximum of 50% of each hour to maintain water circulation to reduce legionella or other biological growth in circulation water.
2. (Reserved) ((~~System shall include means for balancing the flow rate through each individual hot water supply riser or piping zone.~~))
3. ((~~For circulation systems that use a variable flow circulation pump, each riser and piping zone shall have a self-actuating thermostatic balancing valve.~~)) At the end of each riser or piping zone before heated water is returned to the circulation pump, a thermostatic balancing valve or control valve that automatically controls the flow through the riser or piping zone to maintain the domestic hot water supply temperature in the riser at a maximum of 5°F (2.3°C) lower than the design supply water temperature.

EXCEPTION: Multiple riser systems serving Group R and Group I occupancies are not required to have controls that automatically turn off the circulation pump.

C404.7.1.3 Electronic thermostatic mixing valve (TMV). Where a heated water circulation system utilizes an electronic TMV to control the temperature of hot water supplied to the building, the TMV shall be configured so that it either reverts closed (fully COLD) or maintains its current valve position upon power failure or cessation of circulation flow.

C404.7.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1. Controls for such systems shall be able to automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy. Heat trace shall be arranged to be turned off automatically when there is no hot water demand.

C404.7.3 Controls for hot water storage. The controls on pumps that circulate water between a water heater and a heated-water storage tank shall limit operation of the pump from heating cycle startup to not greater than 5 minutes after the end of the cycle.

C404.8 Demand recirculation controls. *Demand recirculation water systems* are not permitted. ((~~shall have controls that comply with both of the following:~~

1. ~~The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~
2. ~~The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C)~~))

C404.9 Domestic hot water meters. Each individual *dwelling unit* in a Group R-2 occupancy with central service domestic hot water systems shall be provided with a domestic hot water meter to allow for domestic hot water billing based on actual domestic hot water usage.

EXCEPTION: *Dwelling units* in other than Group R-2 multi-family and live/work units are not required to provide domestic hot water metering at each *dwelling unit* where domestic hot water is metered separately for each of the following building end uses:

1. *Dwelling units*.
2. Sleeping units.
3. Commercial kitchens.
4. Central laundries.

C404.10 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA B55.2. Potable water-side pressure loss shall be less than 10 psi (69 kPa) at maximum design flow. For Group R occupancies, the efficiency of drain water heat recovery unit efficiency shall be in accordance with CSA B55.1.

C404.11 Energy consumption of pools and permanent spas. The energy consumption of pools and permanent spas shall be controlled by the requirements in Sections C404.11.1 through C404.11.4.

C404.11.1 Heaters. Pool water heaters using electric resistance heating as the primary source of heat are prohibited for pools over 2,000 gallons. Heat pump pool heaters shall have a minimum COP of 4.0 at 50°F (10°C) db, 44.2°F (6.8°C) wb outdoor air and 80°F (27°C) entering water, determined in accordance with AHRI 1160. Other pool heating equipment shall comply with the applicable efficiencies in Section C404.2.

The electric power to all heaters shall be controlled by an on-off switch that is an integral part of the heater, mounted on the exterior of the heater, or external to and within 3 feet of the heater in a location with *ready access*. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with constant burning pilot lights.

C404.11.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pump motors according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

EXCEPTIONS:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

C404.11.3 Covers. Heated pools and permanent spas shall be provided with a vapor-retardant cover on or at the water surface. Pools heated to more than 90°F shall have a pool cover with a minimum insulation value of R-12, and the sides and bottom of the pool shall also have a minimum insulation value of R-12.

C404.11.4 Heat recovery. Heated indoor swimming pools, spas or hot tubs with water surface area greater than 200 square feet shall provide for energy conservation by an exhaust air heat recovery system that heats ventilation air, pool water or domestic hot water. The heat recovery system shall be configured to decrease the exhaust air temperature at design heating conditions (80°F indoor) by 36°F (10°C).

EXCEPTION: Pools, spas or hot tubs that include system(s) that provide equivalent recovered energy on an annual basis through one of the following methods:

1. Solar water heating systems not claimed in Section ((~~C406.5 or~~)) C406.2.5, C407, or C411;
2. Dehumidification heat recovery;
3. Waste heat recovery; or
4. A combination of these system sources capable of and configured to provide at least 70 percent of the heating energy required over an operating season.

C404.12 Portable spas. The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

C404.13 Service water pressure-booster systems. Service water pressure-booster systems shall be designed and configured such that the following apply:

1. One or more pressure sensors shall be used to vary pump speed and/or start and stop pumps. The sensors shall either be located near the critical fixtures that determine the pressure required, or logic shall be employed that adjusts the setpoint to simulate operations of remote sensors.
2. No devices shall be installed for the purpose of reducing the pressure of all of the water supplied by any booster system pump or booster system, except for safety devices.
3. Booster system pumps shall not operate when there is no service water flow except to refill hydro-pneumatic tanks.
4. System pump motors 5.0 hp and greater shall be provided with variable flow capacity in accordance with Section C403.2.4.

C404.14 Demand responsive water heating. Electric storage water heaters with rated water storage volume between 40 and 120 gallons and a nameplate input rating equal to or less than 12kW shall be provided with *demand responsive controls* that comply with ANSI/CTA-2045-B Level 2 or another equivalent *approved demand responsive control*.

EXCEPTIONS:

1. Water heaters that provide a hot water delivery temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code.
3. Water heaters that use three-phase electric power.
4. Storage water heaters with *demand responsive controls* that comply with ANSI/CTA 2045-A or ANSI/CTA 2045-B Level 1, that are also capable of initiating water heating to meet the temperature setpoint in response to a *demand response signal*.

C404.15 Commissioning. Service water heating systems shall be commissioned in accordance with Section C408.

SECTION C405
ELECTRICAL POWER AND LIGHTING SYSTEMS

C405.1 General. Lighting system controls, the maximum lighting power for interior and exterior applications, electrical energy consumption, vertical and horizontal transportation systems, and minimum efficiencies for motors and transformers shall comply with this section. Receptacles shall be controlled according to Section C405.10. *Controlled receptacles* and lighting systems shall be commissioned according to Section C405.12. Solar readiness shall be provided according to Section C411.3 and renewable energy shall be provided according to Sections C411.1, C411.2, and C412.

Dwelling units shall comply with Sections C405.1.1 and C405.7.

Sleeping units shall comply with Section C405.2.6, item 2 and Section C405.1.1 or Section C405.4.

General lighting shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.4.1 and which does not require specific application controls in accordance with Section C405.2.5.

Lighting installed in *walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with the lighting requirements of Section C410.2.

Transformers, uninterruptable power supplies, motors and electrical power processing equipment in *data center systems* shall comply with Section 8 of ASHRAE Standard 90.4 in addition to this code.

EXCEPTION: Energy using equipment used by a manufacturing, industrial or commercial process other than maintaining comfort and amenities for the occupants are exempt from all Section C405 subsections except Section C405.8. Data center and computer room HVAC equipment is not covered by this exemption.

C405.1.1 Lighting for dwelling and sleeping units. No less than 90 percent of the permanently installed lighting serving *dwelling units* or *sleeping units*, excluding kitchen appliance lighting, shall be provided by lamps with a minimum efficacy of 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt.

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following:

1. Lighting controls as specified in Sections C405.2.1 through C405.2.10.
2. *Luminaire-level* lighting controls (LLLC) as specified in Section C405.2.8.1.

EXCEPTION: Except for specific application controls required by Section C405.2.6, lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted.
2. Means of egress illumination serving the exit access that does not exceed 0.01 watts per square foot of building area.
3. Emergency egress lighting that is normally off.
4. Industrial or manufacturing process areas, as may be required for production and safety.

C405.2.1 Occupant sensor controls. Occupant sensor controls shall be installed to control luminaires in the space types listed in Table C405.2.1, and shall comply with the requirements listed in the table.

EXCEPTIONS:

1. Corridors in manufacturing facilities.
2. *General lighting* and task lighting in shop and laboratory classrooms.
3. Luminaires that are required to have specific application controls in accordance with Section C405.2.6 unless specifically required to comply with this section by Section C405.2.6.

Table C405.2.1
Occupant sensor control locations

Space types[a]	Comply with Section
Classrooms/lecture/training rooms	C405.2.1.1
Conference/meeting/multipurpose rooms	C405.2.1.1
Copy/print rooms	C405.2.1.1
Lounge/breakrooms	C405.2.1.1
Enclosed offices	C405.2.1.1
Open plan office areas	C405.2.1.3
Restrooms	C405.2.1.1
Storage rooms	C405.2.1.1
Locker rooms	C405.2.1.1
Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions	C405.2.1.1
Warehouse storage areas	C405.2.1.2
Library stacks	C405.2.1.2
Enclosed fire rated stairways	((~~C405.2.1.5~~)) C405.2.1.4
Corridors	((~~C405.2.1.6~~)) C405.2.1.5
Covered parking	C405.2.10

a. The space types listed include other spaces with substantially similar uses.

C405.2.1.1 Occupant sensor control function. Occupant sensor controls for the space types listed in Section C405.2.1 shall comply with all of the following:

1. They shall be configured to automatically turn off lights within 20 minutes of all occupants leaving the space.
2. They shall be manual on or configured to automatically turn the lighting on to not more than 50 percent power.

   EXCEPTION: Full automatic-on controls with no manual control shall be permitted in corridors, interior parking areas, stairways, restrooms, locker rooms, library stacks, lobbies, and areas where manual operation would endanger occupant safety or security.

3. They shall incorporate a manual control to allow occupants to turn lights off.

   ((~~**EXCEPTION:** Full automatic-on controls with no manual control shall be permitted in corridors, interior parking areas, stairways, restrooms, locker rooms, library stacks, lobbies, and areas where manual operation would endanger occupant safety or security.~~

4. ~~They shall incorporate a manual control to allow occupants to turn lights off.~~))

C405.2.1.2 Occupant sensor control function in warehouse storage areas and library stacks. Lighting in library stacks and warehouse storage areas shall be controlled as follows.

1. Lighting in each aisleway shall be controlled independently of lighting in all other aisleways and open areas.
2. Occupant sensors shall automatically reduce lighting power within each controlled area to an unoccupied setpoint of not more than 50 percent of full power within 20 minutes after all occupants have left the controlled area.
3. Lights which are not turned off by occupant sensors shall ((~~be turned off by time schedule sweep to turn lighting off within 20 minutes of all occupants leaving the space, or~~)) comply with Section C405.2.2 to turn lighting off when the building is vacant.
4. Restore lighting to full power or target light level when occupants enter the space.
5. A *manual* control shall be provided to allow occupants to turn off lights in the space.

C405.2.1.3 Occupant sensor control function in open plan office areas. Occupant sensor controls in open plan office spaces less than 300 square feet (28 m^2) in area shall comply with Section C405.2.1.1. Occupant sensor controls in all other open plan office spaces shall be configured to comply with all of the following:

1. *General lighting* is controlled separately in control zones with floor areas not greater than 600 square feet (55 m^2) within the open plan office space.
2. *General lighting* in each control zone shall be permitted to automatically turn on upon occupancy within the control zone. *General lighting* in other unoccupied zones within the open plan office space shall be permitted to turn on to not more than 20 percent of full power or remain unaffected.
3. Automatically turn off *general lighting* in all control zones within 20 minutes after all occupants have left the open plan office space.
4. *General lighting* in each control zone shall turn off or uniformly reduce lighting power to an unoccupied setpoint of not more than 20 percent of full power within 20 minutes after all occupants have left the control zone.
5. Lighting controls in open plan office areas larger than 5,000 square feet must also comply with Section C405.2.8.

C405.2.1.4 Occupant sensor control function in enclosed fire rated stairways. Occupant sensor controls shall be configured to automatically reduce lighting power by not less than 50 percent when no occupants have been detected in the stairway for a period not exceeding 20 minutes and restore lighting to full power when occupants enter the stairway. All portions of stairways shall remain illuminated to meet the requirements of ((~~Section 1009~~)) Sections 1008 and 1025 of the *International Building Code* when the lighting power is reduced.

C405.2.1.5 Occupant sensor control function in corridors. Occupant sensor controls in *corridors* shall uniformly reduce lighting power to an unoccupied setpoint of not more than 50 percent of full power within 20 minutes after all occupants have left the space.

EXCEPTION: *Corridors* provided with less than two foot-candles of illumination on the floor at the darkest point with all lights on.

C405.2.2 Time switch controls. Each area of the building that is not provided with *occupant sensor controls* complying with Section C405.2.1.1 through Section C405.2.1.5 shall be provided with time switch controls complying with Section C405.2.2.1.

EXCEPTIONS:

1. Luminaires which are required to have specific application controls in accordance with Section C405.2.6 unless specifically required to comply with this section by Section C405.2.6.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation.
5. Shop and laboratory classrooms.

C405.2.2.1 Time switch control function. Time switch controls shall provide programmed shutoff for lighting when building areas are unoccupied and shall comply with the following:

1. Have a minimum 7 day clock.
2. Be capable of being set for 7 different day types per week.
3. Incorporate an automatic holiday "shut-off" feature, which turns off all controlled lighting loads for at least 24 hours and then resumes normally scheduled operations.
4. Have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.

5. Include an override switching device that complies with the following:
   5.1. The override switch shall be a *manual* control.
   5.2. The override switch, when initiated, shall permit the controlled lighting to remain on for not more than 2 hours.
   5.3. Any individual override switch shall control the lighting for an area not larger than ((~~5,000~~)) 2,500 square feet (((~~465~~)) 232 m^2).
6. Time switch controls are allowed to automatically turn on lighting to full power in corridors, lobbies, restrooms, storage rooms less than 50 square feet, and medical areas of health care facilities. In all other spaces, time switch controls are allowed to automatically turn on the lighting to not more than 50 percent power.

EXCEPTION: Within mall concourses, auditoriums, sales areas, manufacturing facilities, pools, gymnasiums, skating rinks, and sports arenas:

1. The time limit shall be permitted to be greater than 2 hours provided the switch is a captive key device.
2. The area controlled by the override switch shall not be limited to 5,000 square feet (465 m^2), provided that such area is less than 20,000 square feet (1860 m^2).

C405.2.3 Manual controls. Stairwells and parking garages are not permitted to use manual switches. All other lighting shall have *manual* controls complying with the following:

1. They shall be in a location with *ready access* to occupants.
2. They shall be located where the controlled lights are visible, or shall identify the area served by the lights and indicate their status.
3. Each control device shall control an area no larger than a single room, or 2,500 square feet, whichever is less, if the room area is less than or equal to 10,000 square feet, or one-quarter of the room area or 10,000 square feet, whichever is less, if the room area is greater than 10,000 square feet.

EXCEPTIONS:

1. A *manual* control may be installed in a remote location for the purpose of safety or security provided each remote control device has an indicator pilot light as part of or next to the control device and the light is clearly labeled to identify the controlled lighting.
2. Restrooms.

C405.2.4 Light reduction controls. Where not provided with occupant sensor controls complying with Section C405.2.1.1, general lighting shall be provided with light-reduction controls complying with Section C405.2.4.1.

Exceptions:

1. Luminaires controlled by daylight responsive controls complying with Section C405.2.5.
2. Luminaires controlled by special application controls complying with Section C405.2.6.
3. Where provided with manual control, the following areas are not required to have light reduction control:
   3.1. Spaces that have only one luminaire with a rated power of less than 60 watts.
   3.2. Spaces that use less than 0.45 watts per square foot (4.9 W/m^2)
   3.3. Corridors, lobbies, electrical rooms and/or mechanical rooms.

C405.2.4.1 Light reduction control function. Manual controls shall be configured to provide light reduction control that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonable uniform illumination pattern with an intermediate step in addition to full on or off, or with continuous dimming control, by using one of the following or another approved method:

1. Continuous dimming of all luminaires from full output to less than 20 percent of full power.
2. Switching all luminaires to a reduced output of not less than 30 percent and not more than 70 percent of full power.
3. Switching alternate rows of luminaires or alternate luminaires to achieve a reduced output of not less than 30 percent and not more than 70 percent of full power.

C405.2.5 Daylight responsive controls. *Daylight responsive controls* complying with Section C405.2.5.1 shall be provided to control the *general lighting* within *daylight zones* in the following spaces:

1. Spaces with a total of more than 75 watts of *general lighting* within *primary sidelit daylight zones* complying with Section C405.2.5.2.
2. Spaces with a total of more than 150 watts of *general lighting* within the combined *primary* and *secondary daylight zones* complying with Section C405.2.5.2.

3. Spaces with a total of more than 75 watts of *general lighting* within *toplit daylight zones* complying with Section C405.2.5.3.

EXCEPTION: *Daylight responsive controls* are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.
2. Sidelit daylight zones on the first floor above grade in Group A-2 and Group M occupancies where the fenestration adjoins a sidewalk or other outdoor pedestrian area, provided that the light fixtures are controlled separately from the general area lighting.

C405.2.5.1 Daylight responsive controls function. Where required, daylight responsive controls shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in primary sidelit daylight zones shall be controlled independently of lights in secondary sidelit daylight zones in accordance with Section C405.2.5.2.
2. Lights in toplit daylight zones in accordance with Section C405.2.5.3 shall be controlled independently of lights in sidelit daylight zones in accordance with Section C405.2.5.2.
3. *Daylight responsive controls* within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
4. Calibration mechanisms shall be in a location with *ready access*.
5. *Daylight responsive controls* shall dim lights continuously from full light output to 15 percent of full light output or lower.
6. *Daylight responsive controls* shall be configured to completely shut off all controlled lights in that zone.
7. When occupant sensor controls have reduced the lighting power to an unoccupied setpoint in accordance with Sections C405.2.1.2 through ((~~C405.2.1.4~~)) C405.2.1.5, *daylight responsive controls* shall continue to adjust electric light levels in response to available daylight but shall be configured to not increase the lighting power above the specified unoccupied setpoint.
8. Lights in sidelit daylight zones in accordance with Section C405.2.5.2 facing different cardinal orientations (i.e., within 45 degrees of due north, east, south, west) shall be controlled independently of each other.

   EXCEPTION: Up to 75 watts of *general lighting* are permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.
9. Incorporate time-delay circuits to prevent cycling of light level changes of less than three minutes.
10. The maximum area a single *daylight responsive control* device serves shall not exceed 2,500 square feet (232 m^2) and no more than 60 lineal feet (18.3 m) of facade.
11. Occupant override capability of daylight dimming controls is not permitted, other than a reduction of light output from the level established by the daylighting controls.
12. *Daylight responsive controls* shall be set initially to activate at 30 footcandles (323 lux) or not more than 110 percent of the illuminance level specified on the construction documents.

C405.2.5.1.1 Dimming. *Daylight responsive controls* shall be configured to automatically reduce the power of *general lighting* in the *daylight zone* in response to available daylight, while maintaining *uniform illumination* in the space through ((~~one of the following methods:~~))

1. Continuous dimming using dimming ballasts/dimming drivers and daylight-sensing *automatic* controls. The system shall reduce lighting power continuously to less than ((~~15~~)) 10 percent of rated power at maximum light output.
2. ((~~Stepped dimming using multi-level switching and daylight sensing controls. The system shall provide a minimum of two steps of uniform illumination between 0 and 100 percent of rated power at maximum light output. Each step shall be in equal increments of power, plus or minus 10 percent.~~

~~General lighting within *daylight zones* in offices, classrooms, laboratories and library reading rooms shall use the continuous dimming method. Stepped dimming is not allowed as a method of *daylight zone* control in these spaces.~~))

C405.2.5.2 Sidelit daylight zone. The sidelit daylight zone is the floor area adjacent to vertical *fenestration* which complies with the following:

1. Where the *fenestration* is located in a wall, the primary sidelit daylight zone shall extend laterally to the nearest full height wall, or up to 1.0 times the height from the floor to the top of the *fenestration*, and longitudinally from the edge of the *fenestration* to the nearest full height wall, or up to 0.5 times the height from the floor to the top of the fenestration, whichever is less, as indicated in Figure C405.2.5.2(1).
2. The secondary sidelit daylight zone is directly adjacent to the primary daylight zone and shall extend laterally to 2.0 times the height from the floor to the top of the *fenestration* or to the nearest full height wall, whichever is

less, and longitudinally from the edge of the *fenestration* to the nearest full height wall or up to ((~~2 feet~~)) 0.5 times the height from the floor to the top of the fenestration, whichever is less, as indicated in Figure C405.2.5.2(1).

3. Where *clerestory fenestration* is located in a wall, the sidelit daylight zone includes a lateral area twice the depth of the *clerestory fenestration* height, projected upon the floor at a 45 degree angle from the center of the *clerestory fenestration*. The longitudinal width of the sidelit daylight zone is calculated the same as for *fenestration* located in a wall. Where the 45 degree angle is interrupted by an obstruction greater than 0.7 times the ceiling height, the sidelit daylight zone shall remain the same lateral area but be located between the clerestory and the obstruction, as indicated in Figure C405.2.5.2(2).
4. Where the *fenestration* is located in a rooftop monitor, the sidelit daylight zone shall extend laterally to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 1.0 times the height from the floor to the bottom of the *fenestration*, whichever is less, and longitudinally from the edge of the *fenestration* to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.25 times the height from the floor to the bottom of the *fenestration*, whichever is less, as indicated in Figures C405.2.5.2(3) and C405.2.5.2(4).
5. If the rough opening area of a vertical fenestration assembly is less than 10 percent of the calculated primary sidelit daylight zone area for this fenestration, it does not qualify as a sidelit daylight zone.
6. The visible transmittance of the fenestration is no less than 0.20.
7. The projection factor (determined in accordance with Equation 4-5) for any overhanging projection which is shading the *fenestration* is not greater than 1.0 for fenestration oriented 45 degrees or less from true north, and not greater than 1.5 for all other orientations.

Figure C405.2.5.2(1)
Sidelit Daylight Zone Adjacent to Fenestration in a Wall

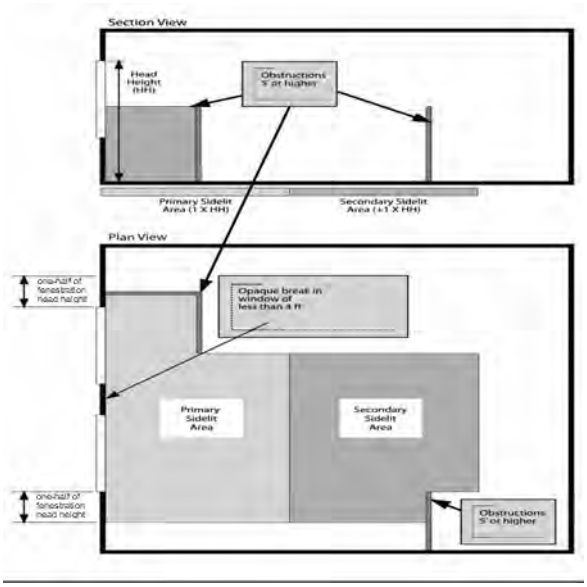


Figure C405.2.5.2(2)
Sidelit Daylight Zone Adjacent to Clerestory Fenestration in a Wall

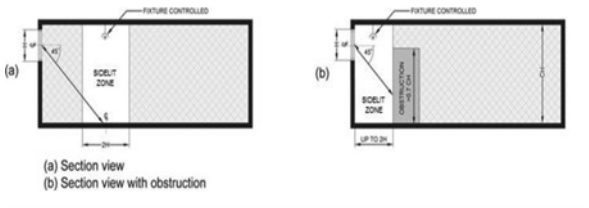


Figure C405.2.5.3(2)
Toplit Daylight Zone Under a Rooftop Monitor

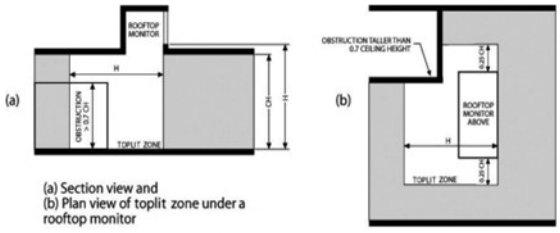
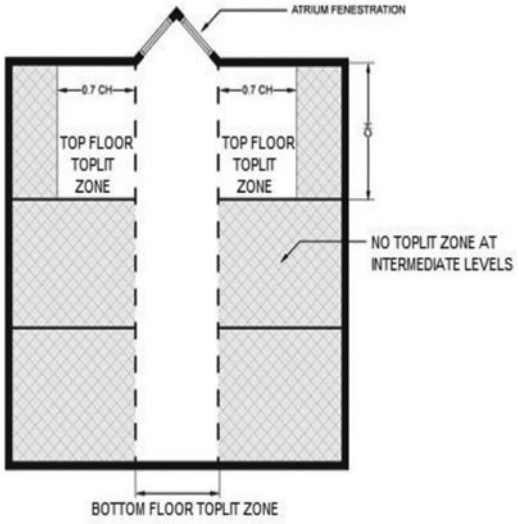


Figure C405.2.5.4
Toplit Daylight Zone Under Atrium Fenestration



C405.2.5.4 Atriums. Daylight zones at atrium spaces shall be established at the top floor surrounding the atrium and at the floor of the atrium space, and not on intermediate floors, as indicated in Figure C405.2.5.4.

C405.2.6 Additional lighting controls. Specific application lighting shall be provided with controls, in addition to controls required by other sections, for the following:

1. The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time switch control complying with Section C405.2.2.1. In addition, a *manual* control shall be provided to control such lighting separately from the *general lighting* in the space:
   1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.4.2.2.1.
   1.2. Display and accent.
   1.3. Lighting in display cases.
   1.4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.
   1.5. Lighting equipment that is for sale or demonstration in lighting education.
   1.6. Display lighting for exhibits in galleries, museums and monuments that is in addition to *general lighting*.
2. *Sleeping units* shall have control device(s) or systems configured to automatically switch off all permanently installed luminaires and switched receptacles, <u>including those installed within furniture,</u> within 20 minutes after all occupants have left the unit.

   EXCEPTIONS:

   1. Lighting and switched receptacles controlled by card key controls.
   2. Spaces where patient care is directly provided.

3. Lighting for life support of ((~~nonhuman life forms~~)) plants and animals and food warming, shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space. ((~~Each control zone shall be no greater than the area served by a single luminaire or 4,000 square feet (372 m^2), whichever is larger.~~))
4. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a manual control.
5. Luminaires serving the exit access and providing means of egress illumination required by Section 1008.2 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination shall be controlled by a combination of listed emergency relay and occupancy sensors, or signal from another building control system, that automatically shuts off the lighting when the areas served by that illumination are unoccupied.

EXCEPTION: Means of egress illumination serving the exit access that does not exceed 0.01 watts per square foot (0.108 W/m^2) of building area is exempt from this requirement.

SDCI Informative Note: The term "exit access" is described in Chapter 10 of the International Building Code, and generally includes all portions of an egress pathway leading to an "exit," which is typically an exterior door or a fire-rated stair enclosure.

C405.2.7 Area controls. The maximum lighting power that may be controlled from a single switch or automatic control device shall not exceed that which is provided by a 20 ampere circuit loaded to not more than 80 percent. A master control may be installed provided the individual switches retain their capability to function independently. Circuit breakers may not be used as the sole means of switching.

EXCEPTION: Areas less than 5 percent of the building footprint for footprints over 100,000 ft^2.

C405.2.8 Advanced lighting controls. Any contiguous open office area larger than 5,000 square feet shall have its *general lighting* controlled by either:

1. *Luminaire-level lighting controls* (LLLC) conforming to the requirements of Section C405.2.8.1.
2. Networked lighting control (NLC) conforming to the requirements of Section C405.2.8.2.

C405.2.8.1 Luminaire-level lighting controls. Where *luminaire-level lighting controls* are required, they shall be configured to provide the controls or equivalent control function specified in Sections C405.2.1, C405.2.3, and C405.2.5. In addition, each LLLC luminaire shall be independently configured to:

1. Provide for continuous full range dimming.
2. Monitor occupant activity to brighten or dim lights when occupied or unoccupied, respectively.
3. Monitor ambient lighting, both electric and daylight, and brighten or dim artificial light to maintain desired light level. A maximum of 8 fixtures are permitted to be controlled together to maintain uniform light levels within a single daylight zone.
4. Allow configuration and reconfiguration of performance parameters for each control strategy including: High trim and low trim setpoints, timeouts, dimming fade rates, and sensor sensitivity adjustment.
5. Construction documents shall include a submittal of a sequence of operations including a specification outlining each of the functions required by this section.
6. Luminaires shall be configured with high end trim in accordance with Section C405.2.8.3.

C405.2.8.2 Networked lighting control (NLC). Where NLC are required, they shall be configured to provide controls and minimum function as specified in Section C405.2. In addition, each NLC luminaire shall be independently configured to:

1. Provide for continuous full range dimming.
2. Each luminaire shall be individually addressed.

   EXCEPTIONS TO ITEM 2:

   1. Multiple luminaires mounted on no more than 12 linear feet of a single lighting track and addressed as a single luminaire.
   2. Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and addressed as a single luminaire, where the total length of the combined luminaires is not more than 12 feet.
   3. Monitor occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.
   4. Monitor ambient lighting, both electric and daylight, and brighten or dim artificial light to maintain desired light level. A maximum of 8 fixtures are permitted to be controlled together to maintain uniform light levels within a single daylight zone.

3. The power to luminaires within 20 feet (6096 mm) of perimeter wall openings shall automatically reduce in response to daylight by at least 50 percent.

EXCEPTIONS TO ITEM 3:

1. Daylight transition lighting for covered vehicle entrances and exits from buildings and parking structures; each transition zone shall not exceed a depth of 66 feet inside the structure and a width of 50 feet.
2. Where permanent screens or architectural elements obstruct more than 50 percent of the opening.
3. Where the top of any existing adjacent structure or natural object is at least twice as high above the openings as its horizontal distance from the opening.

C405.3 Lighting for plant growth and maintenance. ((~~All~~)) In Group F, Group U, and *controlled plant growth environments*, all permanently installed luminaires used for plant growth and maintenance shall have a *photosynthetic photon efficacy* measured at the lamp for luminaires with serviceable or removable lamps or at the luminaire for integrated, nonserviceable luminaires of not less than 1.7 µmol/J for greenhouses and not less than 1.9 µmol/J for all other indoor growing spaces as defined in accordance with ANSI/ASABE S640.

EXCEPTION: Buildings with no more than 10 kW of aggregate horticultural lighting load.

Luminaires used for the growth and maintenance of plants for decorative purposes, in spaces not primarily used for horticulture, shall have a *photosynthetic photon efficacy* measured at the luminaire of not less than 1.4 µmol/J.

C405.4 Interior lighting power requirements. A building complies with this section if its total connected interior lighting power calculated under Section C405.4.1 is no greater than the interior lighting power allowance calculated under Section C405.4.2.

C405.4.1 Total connected interior lighting power. The total connected interior lighting power shall be determined in accordance with Equation 4-13.

$$TCLP = [LVL + BLL + TRK + POE + Other] \quad \textbf{(Equation 4-13)}$$

Where:

TCLP = Total connected lighting power (watts).

LVL = For luminaires with lamps connected directly to building power, such as line voltage lamps, the rated wattage of the lamp, which must be minimum 60 lumens/watt.

BLL = For luminaires incorporating a ballast or transformer, the rated input wattage of the ballast or transformer when operating the lamp.

TRK = For lighting track, cable conductor, rail conductor and plug-in busway systems that allow the addition and relocation of luminaires without rewiring, the wattage shall be one of the following:

1. The specified wattage of the luminaires, but not less than 16 W/lin. ft. (52 W/lin. m).
2. The wattage limit of the permanent current limiting devices protecting the system.
3. The wattage limit of the transformer supplying the system.

POE = For other modular lighting systems served with power supplied by a driver, power supply for transformer including, but not limited to, low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformed published in the manufacturer's catalogs, as specified by UL 2108 or 8750. For power-over-Ethernet lighting systems, power provided to installed nonlighting devices may be subtracted from the total power rating of the power-over-Ethernet systems.

Other = The wattage of all other luminaires and lighting, sources not covered above and associated with interior lighting verified by data supplied by the manufacturer or other approved sources.

The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.

1. Television broadcast lighting for playing areas in sports arenas.
2. Emergency lighting automatically off during normal building operation.
3. Lighting in spaces specifically designed for use by occupants with special lighting needs including those with visual impairment and other medical and age-related issues.
4. Casino gaming areas.
5. General area lighting power in industrial and manufacturing occupancies dedicated to the inspection or quality control of goods and products.
6. Mirror lighting in dressing rooms.
7. Task lighting for medical and dental purposes that is in addition to *general lighting*.
8. Display lighting for exhibits in galleries, museums and monuments that is in addition to *general lighting*.

9. Lighting for theatrical purposes, including performance, stage, film production and video production.
10. Lighting for photographic processes.
11. Lighting integral to equipment or instrumentation and installed by the manufacturer.
12. ((~~Task lighting for plant growth or maintenance where the lamp efficacy is not less than 90 lumens per watt.~~)) Lighting provided exclusively for plant growth and maintenance, in spaces other than Group F, Group U, or *controlled plant growth environments*, where controlled separately from general lighting using an automatic time clock system, with rated fixture efficacy in compliance with Section C405.3.
13. Advertising signage or directional signage.
14. Lighting for food warming.
15. Lighting equipment that is for sale.
16. Lighting demonstration equipment in lighting education facilities.
17. Lighting *approved* because of safety considerations.
18. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
19. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.
20. Exit signs.
21. Lighting used for aircraft painting.
22. Antimicrobial lighting used for the sole purpose of disinfecting a space.

C405.4.2 Interior lighting power allowance. The total interior lighting power allowance (watts) for an entire building shall be determined according to Table C405.4.2(1) using the Building Area Method, or Table C405.4.2(2) using the Space-by-Space Method. The interior lighting power allowance for projects that involve only portions of a building shall be determined according to Table C405.4.2(2) using the Space-by-Space Method. Buildings with unfinished spaces shall use the Space-by-Space Method.

C405.4.2.1 Building area method. For the Building Area Method, the interior lighting power allowance is calculated as follows:

1. For each building area type inside the building, determine the applicable building area type and the allowed lighting power density for that type from Table C405.4.2(1). For building area types not listed, select the building area type that most closely represents the use of that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type.
2. Determine the floor area for each building area type listed in Table C405.4.2(1) and multiply this area by the applicable value from Table C405.4.2(1) to determine the lighting power (watts) for each building area type.
3. The total interior lighting power allowance (watts) for the entire building is the sum of the lighting power from each building area type.

C405.4.2.2 Space-by-Space Method. Where a building has a space designated as unfinished, neither the area nor the lighting power in the space shall be calculated as part of the LPA. For the Space-by-Space Method, the interior lighting power allowance is calculated as follows:

1. For each area enclosed by partitions that are not less than 80 percent of the ceiling height determine the applicable space type from Table C405.4.2(2). For space types not listed, select the space type that most closely represents the proposed use of the space. Where a space has multiple functions, that space shall be broken up into smaller subspaces, each using their own space type. If an entire space has multiple functions that necessitate a higher lighting power allowance in order to serve one of the primary functions, the higher allowance is permitted to be used.
2. Determine the total floor area of all of the spaces of each space type and multiply by the value for the space type in Table C405.4.2(2) to determine the lighting power (watts) for each space type.
3. The total interior lighting power allowance (watts) shall be the sum of the lighting power allowances for all space types.

C405.4.2.2.1 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed in addition to and automatically controlled separately from *general lighting*, in accordance with Section C405.2.6. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose.

An increase in the interior lighting power allowance is permitted for lighting equipment to be installed in sales areas specifically to highlight merchandise. The additional lighting power shall be determined in accordance with Equation 4-14.

$$\text{Additional Interior Lighting Power Allowance} = 500 \text{ watts} + (\text{Retail Area 1} \times 0.45 \text{ W/ft}^2) + (\text{Retail Area 2} \times 0.45 \text{ W/ft}^2) + (\text{Retail Area 3} \times 1.05 \text{ W/ft}^2) + (\text{Retail Area 4} \times 1.87 \text{ W/ft}^2) \quad \textbf{(Equation 4-14)}$$

Where:

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.

Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.

Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

EXCEPTION: Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display requirement is *approved* by the code official.

Table C405.4.2(1)
Interior Lighting Power Allowances—Building Area Method

Building Area Type	~~((LPD (w/ft^2)~~	LPD (w/ft^2)
Automotive facility	~~0.64~~	0.69
Convention center	~~0.64~~	0.61
Court house	~~0.79~~	0.71
Dining: Bar lounge/leisure	~~0.79~~	0.70
Dining: Cafeteria/fast food	~~0.72~~	0.67
Dining: Family	~~0.71~~	0.62
Dormitory ~~((a, b))~~	~~0.46~~	0.49
Exercise center	~~0.67~~	0.68
Fire station ~~((a))~~	~~0.54~~	0.53
Gymnasium	~~0.75~~	0.71
Health care clinic	~~0.70~~	0.77
Hospital ~~((a))~~	~~0.84~~	0.92
Hotel/motel ~~((a, b))~~	~~0.56~~	0.50
Library	~~0.83~~	0.79
Manufacturing facility	~~0.82~~	0.78
Motion picture theater	~~0.44~~	0.41
Multifamily[c]	~~0.41~~	0.44
Museum	~~0.55~~	0.53
Office	~~0.64~~	0.59
Parking garage	~~0.14~~	0.16
Penitentiary	~~0.65~~	0.65
Performing arts theater	~~0.84~~	0.78
Police station	~~0.66~~	0.59
Post office	~~0.65~~	0.61
Religious building	~~0.67~~	0.63
Retail	~~0.84~~	0.74
School/university	~~0.70~~	0.67
Sports arena	~~0.62~~	0.69
Town hall	~~0.69~~	0.64
Transportation	~~0.50~~	0.53
Warehouse	~~0.40~~	0.43
Workshop	~~0.91~~))	0.82

a. Where sleeping units are excluded from lighting power calculations by application of Section R404.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

b. Where *dwelling units* are excluded from lighting power calculations by application of Section R404.1, neither the area of the *dwelling units* nor the wattage of lighting in the *dwelling units* is counted.

c. *Dwelling units* are excluded. Neither the area of the *dwelling units* nor the wattage of lighting in the dwelling units is counted.

Table C405.4.2(2)
Interior Lighting Power Allowances—Space-by-Space Method

Common Space-by-Space Types[a]	~~((LPD (w/ft^2)~~	LPD (w/ft^2)
Atrium - Less than 20 feet in height	~~0.39~~	0.30
Atrium - 20 to 40 feet in height	~~0.48~~	0.39
Atrium - Above 40 feet in height	~~0.60~~	0.48
Audience/seating area - Permanent		
In an auditorium	~~0.61~~	0.54
In a gymnasium	~~0.23~~	0.22
In a motion picture theater	~~0.27~~	0.26
In a penitentiary	~~0.67~~	0.56
In a performing arts theater	~~1.16~~	1.04
In a religious building	~~0.72~~	0.68
In a sports arena	~~0.33~~	0.26
Otherwise	~~0.23~~	0.22
Banking activity area~~((n))~~ i	~~0.61~~	
Breakroom (see lounge/breakroom)		
Classroom/lecture hall/training room		
In a penitentiary	~~0.89~~	0.74
Otherwise~~((m))~~ h	~~0.71m~~	0.68
Computer room, *data center*	~~0.94~~	0.71
Conference/meeting/multipurpose	~~0.97~~	0.84
Copy/print room	~~0.31~~	0.53
Corridor		
In a facility for the visually impaired (and not used primarily by the staff)[b]	~~0.71~~	0.71
In a hospital	~~0.71~~	0.61
Otherwise[c, k]	~~0.41~~	0.42
Courtroom[c]	~~1.20~~	1.03
Dining area		
In a penitentiary	~~0.42~~	0.35
In a facility for the visually impaired (and not used primarily by the staff)[b]	~~1.27~~	1.22
In a bar/lounge or leisure dining~~((n))~~ i	~~0.86~~	0.72
In cafeteria or fast food dining	~~0.40~~	0.34
In a family dining area[n]	~~0.60~~	0.49
Otherwise	~~0.43~~	0.40
Electrical/mechanical	~~0.43~~	0.64
Emergency vehicle garage	~~0.52~~	0.48
Food preparation	~~1.09~~	1.13
Laboratory		
In or as a classroom	~~1.11~~	1.00
Otherwise	~~1.33~~	1.14
Laundry/washing area	~~0.53~~	0.48
Loading dock, interior	~~0.88~~	0.83

Table C405.4.2(2)—continued
Interior Lighting Power Allowances—Space-by-Space Method

Common Space-by-Space Types[a]	((~~LPD (w/ft^2)~~)	~~LPD (w/ft^2)~~
Lobby[c]		
In a facility for the visually impaired (and not used primarily by the staff)[b]	~~1.69~~	1.44
For an elevator	~~0.65~~	0.61
In a hotel	~~0.51~~	0.46
In a motion picture theater	~~0.23~~	0.19
In a performing arts theater	~~1.25~~	1.14
Otherwise	~~0.84~~	0.76
Locker room	~~0.52~~	0.41
Lounge/breakroom((~~n~~)) i		
In a health care facility((~~n~~)) c, i	~~0.42~~	0.77
Otherwise((~~n~~)) i	~~0.59~~	0.52
Office		
Enclosed	~~0.74~~	0.69
Open plan	~~0.61~~	0.53
Parking area, interior	~~0.15~~	0.10
Pharmacy area	~~1.66~~	1.59
Restroom		
In a facility for the visually impaired (and not used primarily by the staff)[b]	~~1.26~~	0.96
Otherwise((~~n~~)) i	~~0.63~~	0.70
Sales area	~~1.05~~	0.81
Seating area, general	~~0.23~~	0.20
((~~Stairway (see space containing stairway)~~))		
Security screening general area		0.64
Security screening in transportation facilities		0.93
Security screening transportation waiting area		0.56
Stairwell((~~n~~)) c, i	~~0.49~~	0.45
Storage room		
< 50 ft^2		0.47
50-100 ft^2		
All other storage	~~0.38~~	0.33
Vehicular maintenance	~~0.60~~	0.56
Workshop	~~1.26~~	1.11
Building Specific Space-by-Space Types[a]	**~~LPD (w/ft^2)~~**	
Automotive (see vehicular maintenance)		
Convention center - Exhibit space	~~0.61~~	0.48
Facility for the visually impaired[b]		
In a chapel (and not used primarily by the staff)[b]	~~0.70~~	0.58
In a recreation room (and not used primarily by the staff)[b]	~~1.77~~	1.20
((~~Fire stations[g]~~ ~~Sleeping quarters~~))	~~0.23~~	

Table C405.4.2(2)—continued
Interior Lighting Power Allowances—Space-by-Space Method

Common Space-by-Space Types[a]	((~~LPD (w/ft^2)~~)	LPD (w/ft^2)
Gaming establishments		
High limits game		1.60
Slots		0.51
Sportsbook		0.78
Table games		1.04
Gymnasium/fitness center		
In an exercise area	~~0.90~~	0.78
In a playing area	~~0.85~~	0.78
Health care facility[c, i]		
In an exam/treatment room	~~1.40~~	1.33
In an imaging room	~~0.94~~	0.94
In a medical supply room	~~0.62~~	0.56
In a nursery	~~0.92~~	0.87
In a nurse's station	~~1.17~~	1.07
In an operating room	~~2.26~~	2.26
In a physical therapy room	~~0.91~~	0.82
In a recovery room	~~1.25~~	1.18
In a telemedicine room		1.44
Library		
In a reading area[((n)) i]	~~0.96~~	0.82
In the stacks	~~1.10~~	1.12
Manufacturing facility		
In a detailed manufacturing area	~~0.80~~	0.71
In an equipment room	~~0.76~~	0.69
In an extra high bay area (greater than 50-foot floor-to-ceiling height)	~~1.42~~	1.29
In a high bay area (25 - 50-foot floor-to-ceiling height)	~~1.24~~	1.18
In a low bay (< 25-foot floor-to-ceiling height)	~~0.86~~	0.81
Museum		
In a general exhibition area[i]	~~0.31~~	0.29
In a restoration room	~~1.10~~	1.18
Performing arts theater dressing/fitting room	~~0.41~~	0.37
Post office - Sorting area	~~0.76~~	0.67
Religious buildings		
In a fellowship hall[((n)) i]	~~0.54~~	0.48
In a worship/pulpit/choir area[((n)) i]	~~0.85~~	0.71
Retail facilities		
In a dressing/fitting room	~~0.51~~	0.43
Hair salon		0.62
Nail salon		0.71
In a mall concourse	~~0.82~~	0.54
Massage space		0.77

Table C405.4.2(2)—continued
Interior Lighting Power Allowances—Space-by-Space Method

Common Space-by-Space Types[a]	((~~LPD (w/ft^2)~~)	~~LPD (w/ft^2)~~
Sports arena - Playing area		
For a Class 1 facility((~~i~~)) d	~~2.94~~	2.72
For a Class 2 facility((~~j~~)) e	~~2.01~~	1.88
For a Class 3 facility((~~k~~)) f	~~1.30~~	1.23
For a Class 4 facility((~~l~~)) g	~~0.86~~	0.81
Sports arena - Pools		
For a Class 1 facility[i]		2.09
For a Class 2 facility[j]		1.40
For a Class 3 facility[k]		0.94
For a Class 4 facility[l]		0.56
Transportation		
Airport Hangar		1.29
In a baggage/carousel area	~~0.39~~	0.27
In an airport concourse	~~0.25~~	0.47
At a terminal ticket counter((~~n~~)) i	~~0.51~~	0.38
Passenger loading area		0.67
Warehouse - Storage area		
For medium to bulky palletized items	~~0.33~~	0.31
For smaller, hand-carried items	~~0.69~~	0.66

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 w/m^2.

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply.
b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.
c. Additional lighting power allowance of 0.2 watts per square foot for the purpose of highlighting art or exhibits. This additional power shall be permitted only where the specified lighting is installed in addition to and controlled separately from general lighting in accordance with Section C405.2.6. This additional power shall be used only for the specified luminaires, shall not be used for any other purpose, and shall not be added to any other space or the interior power allowance.
d. Reserved.
e. Reserved.
f. Reserved.
g. Where sleeping units are excluded from lighting power calculations by application of Section R404.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.
h. Where dwelling units are excluded from lighting power calculations by application of Section R404.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
i. Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.
j. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high school facilities with seating for more than 2,000 spectators.
k. Class III facilities consist of club, amateur league and high school facilities with seating for 2,000 or fewer spectators.
l. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high school facilities without provision for spectators.
m. For classrooms, additional lighting power allowance of 4.50 W/ lineal foot of white or chalk boards for directional lighting dedicated to white or chalk boards.
n. Additional lighting power allowance of 0.15 W/ft^2 for ornamental lighting. Qualifying ornamental lighting includes luminaires that are specifically used in a decorative manner. This additional power shall be permitted only where the specified lighting is installed in addition to and controlled separately from display or general lighting in accordance with Section C405.2.6. This additional power shall be used only for the specified luminaires and it shall not be added to any other space or the interior power allowance.
o. For scientific laboratories, additional lighting power allowance of 0.35 Watts per square foot for specialized task work - lighting that provides for small-scale, cognitive or fast performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical/laboratorial activities.
p. For offices, additional lighting power allowance of 0.20 W/square foot for portable lighting, which includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor
q. Where a space is designated as unfinished, neither the area nor the lighting power in the space shall be calculated as part of the LPA.
r. For corridors, additional lighting power allowance of 0.25 W/square foot for display lighting and decorative lighting is permitted where provided for aesthetic purposes. Decorative lighting fixtures in corridors are also permitted to provide general lighting.

C405.5 Exterior lighting power requirements. The total connected exterior lighting power calculated in accordance with Section C405.5.2 shall not be greater than the exterior lighting power allowance calculated in accordance with Section C405.5.3.

C405.5.1 Exterior building grounds lighting. All exterior building grounds luminaires that operate at greater than 25 watts shall have a minimum efficacy of 100 lumens per watt.

EXCEPTIONS:

1. Luminaires controlled by a motion sensor.
2. Luminaires that qualify for one of the exceptions under Section C405.5.2.

C405.5.2 Total connected exterior building lighting power. The total exterior connected lighting power shall be the total maximum rated wattage of all exterior lighting that is powered through the energy service for the building.

EXCEPTION: Lighting used for the following applications shall not be included:

1. Lighting approved because of safety considerations;
2. Emergency lighting automatically off during normal business operation;
3. Exit signs;
4. Specialized signal, directional and marker lighting associated with transportation;
5. Advertising signage or directional signage;
6. Integral to equipment or instrumentation and is installed by its manufacturer;
7. Theatrical purposes, including performance, stage, film production and video production;
8. Athletic playing areas;
9. Temporary lighting;
10. Industrial production, material handling, transportation sites and associated storage areas;
11. Theme elements in theme/amusement parks;
12. Lighting integrated within or used to highlight features of art, public monuments and the national flag;
13. Lighting for water features and swimming pools; and
14. Lighting that is controlled from within dwelling units, where the lighting complies with Section R404.1.

C405.5.3 Exterior lighting power allowance. The exterior lighting power allowance (watts) is calculated as follows:

1. Determine the Lighting Zone (LZ) for the building according to Table C405.5.3(1), unless otherwise specified by the code official.
2. For each exterior area that is to be illuminated by lighting that is powered through the energy service for the building, determine the applicable area type from Table C405.5.3(2). For area types not listed, select the area type that most closely represents the proposed use of the area. Covered parking garage lighting is not considered exterior lighting for the purposes of this calculation.
3. Determine the total area or length of each area type and multiply by the value for the area type in Table C405.5.3(2) to determine the lighting power (watts) allowed for each area type.
4. The total exterior lighting power allowance (watts) is the sum of the base site allowance determined according to Table C405.5.3(2), plus the watts from each area type.

C405.5.3.1 Additional exterior lighting power. Additional exterior lighting power allowances are available for the specific lighting applications listed in Table C405.5.3(3). These additional power allowances shall be used only for the luminaires serving these applications and shall not be used to increase any other lighting power allowance.

TABLE C405.5.3(1)
EXTERIOR LIGHTING ZONES

Lighting zone	Description
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed us areas
3	All other areas no classified as lighting zone 1, 2 or 4
((4)) Not used	((~~High activity commercial districts in major metropolitan areas as designated by the local land us planning authority~~))

TABLE C405.5.3(2)
LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

	Lighting Zones			
	Zone 1	Zone 2	Zone 3	((~~Zone 4~~
Base Site Allowance	160 W	280 W	400 W	~~560 W~~
Uncovered Parking Areas				
Parking areas and drives	0.015 W/ft^2	0.026 W/ft^2	0.037 W/ft^2	~~0.052 W/ft^2~~
Building Grounds				
Walkways and ramps less than 10 feet wide	0.04 W/ft^2	0.07 W/ft^2	0.10 W/ft^2	~~0.14 W/ft^2~~
Walkways and ramps 10 feet wide or greater, plaza areas, special feature areas	0.04 W/ft^2	0.07 W/ft^2	0.10 W/ft^2	~~0.14 W/ft^2~~
Dining areas	0.156 W/ft^2	0.273 W/ft^2	0.390 W/ft^2	~~0.546 W/ft^2~~
Stairways	Exempt	Exempt	Exempt	~~Exempt~~
Pedestrian tunnels	0.063 W/ft^2	0.110 W/ft^2	0.157 W/ft^2	~~0.220 W/ft^2~~
Landscaping	0.014 W/ft^2	0.025 W/ft^2	0.036 W/ft^2	~~0.050 W/ft^2~~
Building Entrances and Exits				
Pedestrian and vehicular entrances and exits	5.6 W/linear foot of opening	9.8 W/linear foot of opening	14.0 W/linear foot of opening	~~19.6 W/linear foot of opening~~
Entry canopies	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	~~0.252 W/ft^2~~
Loading docks	0.104 W/ft^2	0.182 W/ft^2	0.260 W/ft^2	~~0.364 W/ft^2~~
Sales Canopies				
Free standing and attached	0.20 W/ft^2	0.35 W/ft^2	0.50 W/ft^2	~~0.70 W/ft^2~~
Outdoor Sales				
Open areas (including vehicle sales lots)	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	~~0.252 W/ft^2~~
Street frontage for vehicle sales lots in addition to "open area" allowance	No Allowance	7 W/linear foot	10.3 W/linear foot	~~14.4 W/linear foot~~))

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 W per m^2

TABLE C405.5.3(3)
INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

	Lighting Zones			
	Zone 1	Zone 2	Zone 3	((~~Zone 4~~
Building façade	No allowance	0.075 W/ft^2 of gross above-grade wall area	0.113 W/ft^2 of gross above-grade wall area	~~0.150 W/ft^2 of gross above-grade wall area~~
Automated teller machines (ATM) and night depositories	80 W per location plus 25 per additional ATM	80 W per location plus 25 per additional ATM	80 W per location plus 25 per additional ATM	~~80 W per location plus 25 per additional ATM~~
Uncovered entrances and gatehouse inspection stations at guarded facilities	0.144 W/ft^2	0.252 W/ft^2	0.360 W/ft^2	~~0.504 W/ft^2~~
Uncovered loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.104 W/ft^2	0.182 W/ft^2	0.260 W/ft^2	~~0.364 W/ft^2~~
Drive-up windows/doors	53 W per drive through	92 W per drive through	132 W per drive through	~~185 W per drive through~~
Parking near 24-hour retail entrances	80 W per main entry	140 W per main entry	200 W per main entry	~~280 W per main entry~~))

C405.5.3.1 Additional exterior lighting power. Any increase in the exterior lighting power allowance is limited to the specific lighting applications indicated in Table C405.5.3(3). The additional power shall be used only for the luminaires that are serving these applications and shall not be used for any other purpose.

C405.5.4 Gas lighting. Gas-fired lighting appliances shall not be equipped with continuously burning pilot ignition systems.

C405.5.5 Full cutoff luminaires. For open parking and outdoor areas and roadways, luminaires mounted more than 15 feet above the ground shall have a luminaire light distribution in which zero candela intensity occurs at an angle of 90 degrees above nadir, and all greater angles from nadir.

C405.7.1 Electric receptacles at dwelling unit gas appliances. Where *dwelling unit* appliances are served by natural gas, an electrical receptacle or junction box and circuit shall be provided at each gas appliance with sufficient capacity to serve a future electric appliance in the same location. The receptacles and circuits shall be included in the electrical service load calculation and shall meet the requirements of items 1 through 3 below. The receptacle or junction box for each gas appliance shall be located within 12 inches of the appliance and without obstructions between the appliance and the outlet. An electric receptacle is not required for a decorative gas fireplace.

1. Each gas range, cooktop, or oven, or combination appliance, location shall be served by a dedicated 240/208-volt, 40-amp receptacle connected to the *dwelling unit* electric panel with a 3-conductor branch circuit complying with 210.19(A)(3) of the NEC as adopted by Washington state and a minimum included load of 9600 VA for 240-volt systems or 8000 VA for 208-volt systems.
2. Each gas clothes dryer location shall be served by a dedicated 240/208-volt, 30-amp receptacle connected to the *dwelling unit* electric panel with a 3-conductor branch circuit and a minimum included load of 5000 VA.
3. The location of each gas domestic water heater installed within a *dwelling unit* shall be served by a dedicated 240/208-volt, 30-amp junction box connected to the *dwelling unit* electrical panel with a 3-conductor branch circuit and a minimum included load of 4500 VA.

C405.8 Electric motor efficiency. All electric motors, fractional or otherwise, shall meet the minimum efficiency requirements of Tables C405.8(1) through C405.8(4) when tested and rated in accordance with DOE 10 CFR. The efficiency shall be verified through certification under an approved certification program, or, where no certification program exists, the equipment efficiency rating shall be supported by data furnished by the motor manufacturer.

EXCEPTION: The standards in this section shall not apply to the following exempt electric motors.

1. Air-over electric motors.
2. Component sets of an electric motor.
3. Liquid-cooled electric motors.
4. Submersible electric motors.
5. Inverter-only electric motors.
6. Mechanical ventilation system types with an input power less than 746 watts that comply with the requirements of Section C403.8.4.

Fractional hp fan motors that are 1/12 hp or greater and less than 1 hp (based on output power) which are not covered by Tables C405.8(3) and C405.8(4) shall be electronically commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustment for airflow balancing in lieu of a varying motor speed.

EXCEPTIONS:

1. Motors that are an integral part of specialized process equipment.
2. Where the motor is integral to a listed piece of equipment for which no complying motor has been approved.
3. Motors used as a component of the equipment meeting the minimum efficiency requirements of Section C403.3.2 and Tables C403.3.2(1) through C403.3.2(16), provided that the motor input is included when determining the equipment efficiency.
4. Motors in the airstream within fan coils and terminal units that operate only when providing heating to the space served.
5. ((~~Fan motors that are not covered by Tables C405.8(1) through C405.8(4) and are used to power heat recovery ventilators, energy recovery ventilators, or local exhaust fans in Group R subject to the efficacy requirements of Section C403.8.4.~~)) Mechanical ventilation system types with an input power less than 746 watts that comply with the requirements of Section C403.8.4.
6. Domestic clothes dryer booster fans, range hood exhaust fans, and domestic range booster fans that operate intermittently.
7. Radon and contaminated soil exhaust fans.

((~~8. Group R heat recovery ventilator and energy recovery ventilator fans that are less than 400 cfm.~~))

C405.9.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls that reduce speed as permitted speed in accordance with ASME A17.1/CSA B44 and applicable local code when not conveying passengers.

EXCEPTION: A variable voltage drive system that reduces operating voltage in response to light loading conditions is allowed to be provided in lieu of the variable speed function.

C405.9.2.1 Energy recovery. Escalators shall be designed to recover electrical energy when resisting overspeed in the down direction.

C405.10 Automatic receptacle control. The following shall have automatic receptacle control complying with Section C405.10.1:

1. At least 50 percent of all 125V, 15- and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 50 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.

C405.10.1 Automatic receptacle control function. Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches (304.8 mm) of each uncontrolled receptacle.
2. One of the following methods shall be used to provide control:
   2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5,000 square feet (464.5 m^2) and not more than one floor. The occupant shall be able to manually override an area for not more than 2 hours. Any individual override switch shall control the receptacles of not more than 5,000 feet (1524 m).
   2.2. An occupant sensor control that shall turn off receptacles within 20 minutes of all occupants leaving a space.
   2.3. An automated signal from another control or alarm system that shall turn off receptacles within 20 minutes after determining that the local area is unoccupied.
3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.
4. Plug-in devices shall not ((~~comply~~)) be permitted to substitute for controlled receptacles.

EXCEPTION: Automatic receptacle controls are not required for the following:

1. Receptacles specifically designated for equipment requiring continuous operation (24 hours per day, 365 days per year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, noncontrolled receptacles are permitted to be located more than 12 inches (304.8 mm), but not more than 72 inches (1828 mm) from the controlled receptacles serving that workstation.

SDCI Informative Note: The requirements of this section also apply to rooms and spaces that have substantially similar functions to those listed even when they are labeled with different names. For example, an area designed for office functions that is labeled "work room," or a room used as a classroom that is labeled "student learning" would each be required to provide *controlled receptacles*.

C405.11 Voltage drop. The total voltage drop across the combination of customer-owned service conductors, feeder conductors and branch circuit conductors shall not exceed five percent.

C405.12 Alternating current-output uninterruptible power supplies (AC-output UPS). *AC-output UPS* systems serving a *computer room* shall meet or exceed the calculation and testing requirements identified in ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs) - Eligibility Criteria Version 2.0.

EXCEPTION: AC-output UPC that utilizes standardized NEMA-1-15P or NEMA 5-15P input plug, as specified in ANSI/NEMA WD 6.

C405.13 Commissioning. Controlled receptacles and lighting systems shall be commissioned in accordance with Section C408.

C405.14 Commercial food service. The following types of equipment within the scope of the applicable Energy Star program shall comply with the energy-efficiency and water-efficiency criteria required to achieve the Energy Star label:

a. Commercial fryers: Energy Star Program Requirements for Commercial Fryers.

b. Commercial hot food holding cabinets: Energy Star Program Requirements for Hot Food Holding Cabinets.

c. Commercial steam cookers: Energy Star Program Requirements for Commercial Steam Cookers.

d. Commercial dishwashers: Energy Star Program Requirements for Commercial Dishwashers.

C405.14.1 Electric power at gas-fired commercial cooking appliances. Where gas-fired commercial cooking appliances in commercial kitchens are provided in a building permitted under this 2021 edition of the Seattle Energy Code, an electrical panel shall be provided within or adjacent to each space in which commercial cooking appliances are located, sized to serve future electric appliances to replace all gas-fired appliances in the space with a minimum capacity of 293 VA per kBTUH of gas appliance input capacity. The main electric service panel for the building shall be wired to and sized to accommodate all such commercial cooking appliance panels. Permit documents shall include a table listing each gas-fired commercial cooking appliance as well as an equivalent electric appliance providing the same or greater cooking capacity, and the total amperage required for the commercial kitchen electrical panel. This information shall be provided in both the mechanical and the electrical permit documents.

EXCEPTION: This requirement does not apply to gas-fired commercial cooking appliances installed in buildings originally permitted in compliance with an earlier edition of the Seattle Energy Code, if the building's main service panel lacks sufficient capacity to provide power for equivalent electric versions of all the gas-fired commercial cooking appliances identified in the permit application.

SECTION C406
ADDITIONAL ENERGY EFFICIENCY AND LOAD MANAGEMENT CREDITS

C406.1 Additional energy efficiency and load management measures credit requirements. The project as defined in the building permit shall meet the following requirements as applicable:

1. New buildings, changes in *space conditioning category*, change of occupancy group, and building additions in accordance with Chapter 5 shall comply with sufficient measures from Section C406.2 so as to achieve the minimum number of required efficiency credits shown in Table C406.1.
2. New buildings greater than 5000 gross square feet of floor area shall comply with sufficient measures from Section C406.3 so as to achieve the minimum number of required load management credits shown in Table C406.1.
3. Tenant spaces shall comply in accordance with Section C406.1.1.

SDCI Informative Note: In this section "tenant space" means any conditioned area within a new building that is constructed for first occupancy under a separate permit from the shell and core permits.

4. Projects using discrete area credit weighting shall comply in accordance with Section C406.1.2.

EXCEPTIONS:

1. Low energy spaces in accordance with Section C402.1.1.1, equipment buildings in accordance with Section C402.1.2, unconditioned spaces, open parking garages, and enclosed parking garages that comply with sufficient measures from Table C406.2(1) to achieve a minimum of 50 percent of the efficiency credits required for new construction. Such projects shall be exempt from the load management requirements in Table C406.1.
2. Building additions that have less than 1,000 square feet of *conditioned floor area* that comply with sufficient measures from Table C406.2(1) to achieve a minimum of 50 percent of the efficiency credits required for additions.
3. Warehouses are exempt from the load management credit requirements in Table C406.1.

Table C406.1
Energy Measure Credit Requirements

Required Credits for Projects	Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
New building energy efficiency credit requirement	C406.2	54	41	42	48	74	49
Building additions energy efficiency credit requirement	C406.2	27	20	21	23	36	21
New building load management credit requirement	C406.3	12	15	27	15	13	26

C406.1.1 Tenant spaces. An initial tenant improvement shall comply with sufficient measures from Table C406.2(1) to achieve a minimum of efficiency credits required in Table C406.1 and are not required to achieve any load management credits. In projects with multiple tenant spaces, each tenant space is permitted to apply for different measures provided the weighted average of all areas in the project ((~~comply~~)) complies with the overall efficiency credit requirement in Table C406.1. Whole building or addition energy credits shall be allocated to tenant spaces in accordance with Sections C406.1.1.1 and C406.1.1.2. This provision only applies to the initial buildout of a tenant space.

EXCEPTIONS:

1. An initial tenant improvement where the core and shell building complied via Section C407 in 2018 or later edition of the ((~~Washington State~~)) Seattle Energy Code.
2. Previously occupied tenant spaces in existing buildings that comply with this code in accordance with Section C501.

C406.1.1.1 Applicable envelope, renewable and elevator energy credits. Where an entire building or building addition complies with Section ((~~C406.2.4, C406.2.9, C406.2.10, or C406.2.14~~)) C406.2.5, C406.2.12, C406.2.13, or C406.2.18, under an initial tenant improvement permit, tenant spaces within the building qualify for the number of credits assigned to the occupancy group of the tenant space in accordance with Table C406.2(1). Where prior energy credits were achieved under the 2018 Washington State Energy Code, they shall be multiplied by 6 for applicability to this code.

C406.1.1.2 Applicable HVAC and service water heating credits. Where HVAC and service water heating systems and services are installed and comply with Section ((~~C406.2.4,~~)) C406.2.2, C406.2.8, or C406.2.9, ((~~C406.2.10, or C406.2.14~~)) under an initial tenant improvement permit, those systems and services shall be considered a part of the tenant space. Tenant spaces qualify for the credits assigned to the occupancy group of the tenant space in accordance with Table C406.2(1) if the tenant space includes the distribution system and equipment that the central HVAC systems or service water heating systems were designed to support.

C406.1.2 Discrete area-weighted project compliance. Discrete building areas are permitted to select different packages of measures provided that the whole project complies with both the energy and load management credit requirements. Compliance shall be determined as follows:

1. Required project credits shall be prorated on an area-weighted basis for each occupancy group by multiplying the occupancy group floor area by the number of credits required, and then dividing this value by the total area of all the occupancy groups combined. Where one occupancy group is less than 10 percent of the floor area of the project, use the primary occupancy group for those credits.
2. Occupancies are permitted to be subdivided into discrete areas, with required and achieved credits for each area prorated on an area-weighted basis as required for the occupancy group.
3. Where envelope or lighting power credits in Section C406.2.3.1, C406.2.3.2, or C406.2.3.12 are applied, the lighting power or envelope UA percentage reduction shall be calculated for the project as a whole to determine achieved credits.
4. Determine total project credits achieved by area-weighting the achieved credits by occupancy group in the same manner as for required project credits.
5. A project complies when the achieved number of area-weighted energy and load management credits are equal to or greater than the required area-weighted number of credits.

C406.2 Additional energy efficiency credit measures. Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.14 shall achieve the credits listed for the measure and occupancy group in Table C406.2(1) or Table C406.2(2) or where calculations required by Sections C406.2.1 through C406.2.14 create or modify the table credits, the credits achieved shall be based upon the section calculations. Projects that ((~~chose~~)) choose to comply with either fossil fuel pathway in Section C406.1.3 shall use Table C406.2(2) to achieve credits.

For mixed fuel space heating systems, the number of space heating energy efficiency credits available for measures with a prorating flag "Heat" are calculated using the following equation:

$$C_{SH} = CHP_{SH} \times B/C + CFF_{SH} \times (1 - B/C)$$

Where:

C_{SH} = Blended credits for mixed fuel systems.
CHP_{SH} = Credits available in Table C406.2(1).
CFF_{SH} = Credits available in Table C406.2(2).

B = Installed space heating capacity in kBTU/h of space heating appliances that comply with Section C403.1.4 or any of the exceptions to Section C403.1.4.

C = Total installed space heating capacity in kBTU/h of all space heating appliances.

For mixed fuel service water heating systems, the number of service water heating energy efficiency credits available for measures with a prorating flag "SWH" are calculated using the following equation:

$$C_{WH} = CHP_{WH} \times B/C + CFF_{WH} \times (1 - B/C)$$

Where:

C_{WH} = Blended credits for mixed fuel systems.

CHP_{WH} = Credits available in Table C406.2(1).

CFF_{WH} = Credits available in Table C406.2(2).

B = Installed service water heating capacity in kBTU/h of service water heating appliances that comply with ((~~any of the~~)) Section C404.2.1 or exceptions 1, 2, 5, 7, or 8 to Section C404.2.1, but not including the supplemental capacity permitted by Section C404.2.1.4, and without utilizing Section C401.3.

C = Total installed service water heating capacity in kBTU/h of all service water heating appliances, but not including the supplemental capacity permitted by Section C404.2.1.4.

Table C406.2(1)
Efficiency Measure Credits

Measure Title	Applicable Section	Prorating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	((~~C406.2.2~~)) C406.2.1	Heat	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR[a]	C406.2.2.1	Heat	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	Heat	((~~2~~)) 8	((~~2~~)) 5	((~~3~~)) 10	((~~4~~)) 10	((~~3~~)) 8	((~~2~~)) 8
4. Improve heating efficiency	C406.2.2.3	Heat	((~~2~~)) 1	((~~3~~)) 1	((~~3~~)) 1	((~~10~~)) 1	((~~16~~)) 2	((~~7~~)) 1
5. Improved low-carbon district energy system (10% better)	C406.2.2.4		3	3	4	11	17	8
6. Improved low-carbon district energy system (20% better)[b]	C406.2.2.5		9	10	12	33	52	24
7. High performance DOAS	C406.2.2.6	Heat	31	31	21	39	40	21/ (Group A: 40)[c]
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	2	2	2	6	9	4
9. 10% reduced lighting power	C406.2.3.1	Heat	7	4	18	16	((~~20~~)) 36	((~~15~~)) 16
10. 20% reduced lighting power[d]	C406.2.3.2	Heat	13	8	36	32	((~~52~~)) 72	((~~29~~)) 32
11. Lamp efficacy improvement	C406.2.3.3	Heat	5	6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	1	6	6	11	((~~6~~)) 5
14. Renewable energy	C406.2.5		7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	SWH	9	30	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	SWH	35	111	13	14	(Grocery) 41[e]	NA
((~~17. Heat pump water heating~~	~~C406.2.6.3~~	~~SWH~~	~~81~~	~~261~~	~~17~~	~~33~~	~~(Grocery) 95~~[e]	~~(A-2) 95~~[f]))
17. High efficiency service water heating, gas-fired	C406.2.6.4	SWH	NA	NA	NA	NA	NA	NA
18. Heat trace system	C406.2.7.1	SWH	6	13	4	1	NA	6
19. Point of use water heater	C406.2.7.2	SWH	NA	NA	19	5	NA	NA
20. Service hot water distribution right sizing	C406.2.8	SWH	((~~13~~)) NA	((~~42~~)) 10	NA	NA	NA	NA
21. High performance service hot water temperature maintenance system	C406.2.9	SWH	6	13	4	1	NA	6

Table C406.2(1)—continued
Efficiency Measure Credits

Measure Title	Applicable Section	Prorating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
((~~22. High efficiency service hot water circulation system~~	~~C406.2.10~~	~~SWH~~	~~3~~	~~6~~	~~2~~	~~1~~	~~NA~~	~~4~~))
23. Low flow residential showerheads	C406.2.11	SWH	3	3	NA	NA	NA	NA
24. Enhanced envelope performance[g]	C406.2.12	Heat	24	20	13	5	19	((~~14~~)) 16
25. Base reduced air leakage[g]	C406.2.13.2		29	24	6	3	9	((~~11~~)) 14
26. Enhanced reduced air leakage[g]	C406.2.13.3	Heat	53	44	11	5	16	((~~20~~)) 26
((~~27. Enhanced commercial kitchen equipment~~	~~C406.2.14~~	~~Heat~~	~~30[h]~~	~~18[h]~~	~~18[h]~~	~~30[h]~~	~~30[h]~~	~~31[h]~~))
28. Enhanced residential kitchen equipment	C406.2.15	Heat	12	19	NA	NA	NA	NA
29. Enhanced residential laundry equipment	C406.2.16	Heat	NA	6	NA	NA	NA	NA
30. Heat pump clothes dryers	C406.2.17	Heat	6	6	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	Heat	3	5	5	5	4	4

a. Projects using Item 2 shall not use Items ((~~3 through 5~~)) 3, 4, or 7.
b. Projects using C406.2.2.5 shall not use C406.2.2.4.
c. For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.
d. Projects using C406.2.3.2 shall not use C406.2.3.1.
e. Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft^2. Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.
f. Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.
g. Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.

((~~h. Additional energy efficiency credits, up to the maximum shown in Table C406.2(2), shall be calculated according to Section C406.2.14.~~))

Table C406.2(2)
Efficiency Measure Credits for use with Fossil Fuel Compliance Path

Measure Title	Applicable Section	Prorating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.2	Heat	NA	8	NA	NA	NA	NA
2. Improved HVAC TSPR[a]	C406.2.2.1	Heat	NA	9	12	19	24	NA
3. Improve cooling and fan efficiency	C406.2.2.2	Heat	12	8	14	8	10	10
4. Improve heating efficiency	C406.2.2.3	Heat	2	3	3	11	18	8
5. Improved low-carbon district energy system (10% better)	C406.2.2.4		3	3	4	12	19	9
6. Improved low-carbon district energy system (20% better)[b]	C406.2.2.5		10	11	13	36	57	26
7. High performance DOAS	C406.2.2.6	Heat	34	34	23	43	44	23/ (A) 40[c]
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	2	2	2	6	9	4
9. 10% reduced lighting power	C406.2.3.1	Heat	7	4	18	16	20	15
10. 20% reduced lighting power[d]	C406.2.3.2	Heat	13	8	36	32	40	29
11. Lamp efficacy improvement	C406.2.3.3	Heat	5	6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	1	6	6	11	6
14. Renewable energy	C406.2.5		7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	SWH	10	33	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	SWH	35	111	13	14	(Grocery) 41[e]	NA
17. Heat pump water heating	C406.2.6.3	SWH	81	261	17	33	(Grocery) 95[e]	(A-2) 95[f]
18 High efficiency service water heating, gas-fired	C406.2.6.4	SWH	59	65	6	11	18	32
((~~18~~)) 19. Heat trace system	C406.2.7.1	SWH	6	13	4	1	NA	6
((~~19~~)) 20. Point of use water heater	C406.2.7.2	SWH	NA	NA	19	5	NA	NA

Table C406.2(2)—continued
Efficiency Measure Credits for use with Fossil Fuel Compliance Path

Measure Title	Applicable Section	Prorating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
((~~20~~)) 21. Service hot water distribution right sizing	C406.2.8	SWH	((~~13~~)) NA	((~~42~~)) 10	NA	NA	NA	NA
((~~21~~)) 22. High performance service hot water temperature maintenance system	C406.2.9	SWH	6	13	4	1	NA	6
((~~22. High efficiency service hot water circulation system~~	~~C406.2.10~~	~~SWH~~	~~3~~	~~6~~	~~2~~	~~1~~	~~NA~~	~~4~~))
23. Low flow residential showerheads	C406.2.11	SWH	3	3	NA	NA	NA	NA
24. Enhanced envelope performance[g]	C406.2.12	Heat	24	20	13	5	19	14
25. Base reduced air leakage[g]	C406.2.13.2		29	24	6	3	9	11
26. Enhanced reduced air leakage[g]	C406.2.13.3	Heat	53	44	11	5	16	20
((~~27. Enhanced commercial kitchen equipment~~	~~C406.2.14~~	~~Heat~~	~~30[h]~~	~~18[h]~~	~~18[h]~~	~~30[h]~~	~~30[h]~~	~~31[h]~~))
28. Enhanced residential kitchen equipment	C406.2.15	Heat	12	19	NA	NA	NA	NA
29. Enhanced residential laundry equipment	C406.2.16	Heat	NA	6	NA	NA	NA	NA
30. Heat pump clothes dryers	C406.2.17	Heat	6	6	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	Heat	3	5	5	5	4	4

a. Projects using Item 2 shall not use Items ((~~3 through 5~~)) 3, 4, or 7.
b. Projects using C406.2.2.5 shall not use C406.2.2.4.
c. For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.
d. Projects using C406.2.3.2 shall not use C406.2.3.1.
e. Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft^2. Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.
f. Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.
g. Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.
((~~h. Additional energy efficiency credits, up to the maximum shown in Table C406.2(2), shall be calculated according to Section C406.2.14.~~))

C406.2.1 Dwelling unit and Group R-1 sleeping unit HVAC controls. HVAC systems serving *dwelling units* or Group R-1 *sleeping units* shall be controlled with a programmable *thermostat* that is configured to automatically activate a setback condition of at least 5°F (3°C) for both heating and cooling. The programmable *thermostat* shall be configured to provide setback during occupied sleep periods. The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

1. A manual main control device by each *dwelling unit* or Group R-1 sleeping unit main entrance that initiates setback for all HVAC units in the *dwelling unit* and is clearly identified as "Heating/Cooling Master Setback."
2. Occupancy sensors in each room of the *dwelling unit* or Group R-1 sleeping unit combined with a door switch to initiate setback for all HVAC units in the dwelling within 20 minutes of all spaces being vacant immediately following a door switch operation. Where separate room HVAC units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this requirement.
3. An advanced learning thermostat that senses occupant presence and automatically creates a schedule for occupancy and provides a dynamic setback schedule based on when the spaces are generally unoccupied.
4. An automated control and sensing system that uses geographic sensing connected to the *dwelling unit* occupants' cell phones and initiates the setback condition when all occupants are away from the building.

C406.2.2 More efficient HVAC system performance. All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to the minimum efficiency requirements listed in the tables in Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/IEER, IPLV or AFUE. Equipment that is larger than the maximum capacity range indicated in the tables in Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity. This credit shall not be utilized for low energy or semi-heated *space conditioning categories*. No HVAC systems incorporating fossil fuel-fired equipment, or heat from district energy systems that are primarily heated by fossil fuel combustion, are permitted to utilize this credit unless the Section C401.3 fossil fuel compliance path is utilized for energy code compliance.

Where:

$AMLC_{DES}$ = As-designed annualized mechanical load component calculated in accordance with ASHRAE 90.4 Section 6.5.

$AMLC_{MAX}$ = Maximum annualized mechanical load component from ASHRAE 90.4 Table 6.5.

C406.2.2.2.3 Minimum fan efficiency. Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1.

C406.2.2.3 More efficient HVAC equipment heating performance. No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, building addition or tenant space in accordance with Section C406.1.1 shall comply with Sections C406.2.2.3.1 through C406.2.2.3.2.

C406.2.2.3.1 HVAC system selection. Equipment installed shall be types that are listed in the tables in Section C403.3.2. Electric resistance heating shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental heating. No HVAC systems incorporating fossil fuel-fired equipment, or heat from district energy systems that are primarily heated by fossil fuel combustion, are permitted to utilize this credit unless the Section C401.3 fossil fuel compliance path is utilized for energy code compliance.

C406.2.2.3.2 Heating equipment efficiency. Equipment shall exceed the minimum heating efficiency requirements of the tables in Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficiency credits for heating shall be determined using Equation 4-16, rounded to the nearest whole number.

$$EEC_{HEH} = EEC_5 \times \left[1 + \frac{HEI - 0.05}{0.05}\right] \quad \textbf{(Equation 4-16)}$$

Where:

EEC_{HEH} = Energy efficiency credits for heating efficiency improvement.

EEC_5 = Section C406.2.2.2 credits from Table C406.2(1).

HEI = The lesser of the improvement above minimum heating efficiency requirements or 20 percent (0.20). Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined. For metrics that increase as efficiency increases, HEI shall be calculated as follows:

$$HEI = \frac{HM_{DES}}{HM_{MIN}} - 1$$

Where:

HM_{DES} = Design heating efficiency metric, part-load or annualized where available.

HM_{MIN} = Minimum required heating efficiency metric, part-load or annualized where available from Section C403.3.2.

EXCEPTION: In low energy spaces complying with Section C402.1.1 and *semi-heated spaces* complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall achieve credits for EEC_5.

C406.2.2.4 Improved low-carbon district energy systems (10 percent better). Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space heating, and space cooling load shall meet the criteria of Section C406.2.2.4.1 or C406.2.2.4.2.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition as modified in Section C406.2.2.4.1 or C406.2.2.4.2 of *low-carbon district energy exchange system* is satisfied.

C406.2.2.4.1 Improved low-carbon district energy exchange systems (10 percent better). Low-carbon district energy exchange systems must demonstrate the following:

1. Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources; and
2. No more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.

C406.2.2.4.2 Improved low-carbon district energy heating and cooling or heating only systems (10 percent better). Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district energy heating and cooling or heating only systems* must demonstrate the following:

1. Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources; or
2. No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 3.0.

C406.2.2.5 Improved low-carbon district energy systems (20 percent better). Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space heating, and space cooling load shall meet the criteria of Section C406.2.2.5.1 or C406.2.2.5.2.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition as modified in Section C406.2.2.4.1 or C406.2.2.4.2 of *low-carbon district energy exchange system* is satisfied.

C406.2.2.5.1 Improved low-carbon district energy exchange systems (20 percent better). Low-carbon district energy exchange systems must demonstrate the following:

1. Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources; and
2. No more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.

C406.2.2.5.2 Improved low-carbon district energy heating and cooling or heating only systems (20 percent better). Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district energy heating and cooling or heating only systems* must demonstrate the following:

1. Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources; or
2. No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 4.0.

C406.2.2.6 High performance dedicated outdoor air system (DOAS). No less than 90 percent of the total conditioned floor area of the whole project, excluding floor area of unoccupied spaces that do not require ventilation as specified by the *International Mechanical Code*, shall be served by DOAS installed in accordance with Section C403.3.5 with the following adjustments:

1. Minimum heat recovery sensible effectiveness of 80 percent, calculated in accordance with Section C403.3.5.1, or C403.7.6.1 for R-2 occupancies.
2. Where design outdoor airflow is greater than 500 cfm (250 L/s), the DOAS shall be equipped with an economizer bypass, damper control, or wheel speed control that is active between 55°F (13°C) and 75°F (24°C) outdoor air temperature and minimizes energy recovery or maintains an appropriate DOAS leaving air temperature when the building is generally in cooling, based either on outdoor air temperature or a DDC zone-based cooling system reset.
3. DOAS total combined fan power shall comply with the fan power limits in Table C403.8.4 where applicable and shall be less than either:
   3.1. 0.769 W/cfm (1.55 W/L/s) when calculated in accordance with Section C403.3.5.2.
   3.2. Eighty percent of fan power allowance for a constant volume system when calculated in accordance with Section ((~~C406.8.1~~)) C403.8.1.

This option is not available to areas served by systems utilizing Section C403.2.2.1 exception 5. No HVAC systems incorporating fossil fuel-fired equipment, or heat from district energy systems that are primarily heated by fossil fuel

combustion, are permitted to utilize this credit unless the Section C401.3 fossil fuel compliance path is utilized for energy code compliance.

C406.2.2.7 Fault detection and diagnostics system. A project not required to comply with Section C403.2.3 or C403.6.10(16) shall achieve energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with items 1 through 6 in Section C403.2.3.

C406.2.3 Reduced lighting power. Interior lighting within the whole project, consisting of a whole building, building area, occupancy type, building addition, or tenant space, shall achieve credits by complying with Section C406.2.3.1 or C406.2.3.2. In Group R-1 and Group R-2 occupancies, dwelling and sleeping units shall comply with Section C406.2.3.3 and all other areas shall comply with section C406.2.3.1 or C406.2.3.2. Credits apply to the whole Group R-1 or Group R-2 area.

C406.2.3.1 Reduced lighting power option 1. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 90 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types, or 90 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.2 Reduced lighting power option 2. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 80 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area of the building types, or 80 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.3 Lamp efficacy. No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 90 lumens per watt.

C406.2.4 Lighting controls. For buildings with nontransient dwelling units and sleeping units, energy credits shall be achieved by installation of systems that comply with the requirements of Section C406.2.4.1. All other buildings shall achieve energy credits by complying with Section C406.2.4.2. For buildings with mixed occupancies, credits shall be prorated based on floor area.

C406.2.4.1 Residential building lighting control. In buildings with nontransient *dwelling units* and *sleeping units*, lighting controls shall be configured to meet the following:

1. Each *dwelling unit* or *sleeping unit* shall have a main control by the main entrance that turns off all the lights and switched receptacles in the unit. The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls shall be clearly identified as "lights master off" and "switched outlets master off."
2. Switched receptacles shall be clearly identified and all switched receptacles shall be located within 12 inches of an unswitched receptacle. Each room shall have a minimum of two switched receptacles except bathrooms, kitchens, and closets.

C406.2.4.2 Enhanced digital lighting controls. Measure credits shall be achieved where no less than 50 percent of the gross floor area within the project has luminaires and lighting controls that include high end trim in compliance with Section C405.2.8.3 and either *luminaire-level lighting controls* in compliance with Section C405.2.8.1 or networked lighting controls in accordance with Section C405.2.8.2. Open office areas subject to the requirements of Section C405.2.8 are not permitted to take credit for this option. Where *general lighting* in more than 50 percent of the gross floor area complies, the base credits from Table C406.2(1) shall be prorated as follows:

[Floor area with high end trim, %] × [Base energy credits for C406.2.4.2] / 50%

C406.2.5 On-site and off-site renewable energy. Projects installing on-site or off-site renewable energy systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m^2) of building area in addition to the renewable energy capacity required elsewhere in this code shall achieve energy credits for this measure. Renewable energy systems achieving energy credits shall not be used to satisfy other requirements of this code. Off-site renewable energy systems shall comply with Sections C411.2.2 and C411.2.3. Credits shall be prorated from the table value in accordance with Equation 4-17.

$$AEC_{RRa} = AEC_b \times \frac{\sum(REF \times RR_t) - RR_r}{RR_b \times PGFA} \qquad \textbf{(Equation 4-17)}$$

Where:

AEC_{RRa} = Section C406.2.5 achieved energy credits for this project as calculated in accordance with Equation 4-17, limited to 50 percent of the required credits in Section C406.1.

RR_t = Actual total rating of on-site and off-site renewable energy systems (W) for each type of renewable energy source in Table C411.2.1.

RR_r = Rating of renewable energy systems required by Section C411.1, other sections in this code, or used to qualify for exceptions in this code (W).

RR_b = 0.1 W/square foot (1.08 W/m^2)

PGFA = Project gross floor area, square feet (m^2).

AEC_b = Section C406.2.5 base credits from Table C406.2(1).

REF = Renewable Energy Factor from Table C411.2.1.

Informative Note: On-site renewable energy may include thermal service water heating or pool water heating, in which case ratings in Btu/h can be converted to W where W = Btu/h / 3.413.

C406.2.6 Reduced energy use in service water heating. Buildings with service hot water heating equipment that serves the whole building, building addition or tenant space shall achieve credits through compliance with:

1. Section C406.2.6.1, C406.2.6.2, or C406.2.6.3.
2. Sections C406.2.6.1 and C406.2.6.2.
3. Sections C406.2.6.1 and C406.2.6.3.

No service water heating systems incorporating fossil fuel-fired equipment, or heat from district energy systems that are primarily heated by fossil fuel combustion, are permitted to utilize this credit.

C406.2.6.1 Shower drain heat recovery. Shower drain heat recovery units shall comply with Section C404.10 and preheat cold water supply to the showers. Potable waterside pressure loss shall be less than 10 psi (69 kPa) at maximum design flow. The efficiency of drain water heat recovery units shall be no less than 54 percent in accordance with CSA B55.1. Full credits are applicable to the following building use types: Multi-family, hotel, motel, dormitory, and schools with locker room showers. Where not all showers in the project have drain heat recovery, the credit is adjusted based on the following:

[Section C406.2.6.1 table credits] × [Showers with drain recovery] / [Total number of showers]

C406.2.6.2 Service water heating energy recovery. Not less than 30 percent of the annual service hot water heating energy use, or not less than 70 percent of the annual service hot water heating energy use in buildings with condenser water systems subject to the requirements of Section C403.9.2.1 or qualifying for one of its exceptions, shall be provided by one or more of the following:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or other *approved* system. Qualifying heat recovery must be above and beyond heat recovery required by other sections of this code.
2. On-site renewable energy water-heating systems where not used to meet other requirements or to obtain other energy credits.

C406.2.6.3 Heat pump water heating. Projects shall achieve credits through compliance with Section C406.2.6.3.1.

C406.2.6.3.1 Heat pump water heater. Credit shall be achieved where the primary heat pump service water heating system is sized to deliver no less than 100 percent of the net calculated demand for service water production during the peak demand period with entering dry bulb or wet bulb outdoor air temperature at 40°F (4°C) for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps, as calculated using the equipment manufacturer's selection criteria or another *approved* methodology. For this credit, the net calculated demand shall be the gross building demand less any portion of the demand complying with the exceptions to Section C404.2.1. Supplemental heating is permitted in accordance with Section C404.2.1, but cannot use fossil fuels. The refrigerant used in the heat pump system must have a global warming potential (GWP) no greater than 680. Heat pump water heaters shall comply with one of the following:

1. The COP rating shall be a minimum COP of 3.0 reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (16°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering load water temperature of 74°F (23°C) or lower.
2. The uniform energy factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of Energy requirements.

C406.2.6.4 High efficiency service water heating, gas-fired. The credit achieved shall be from Table C406.2(2) where hot water is supplied by gas-fired equipment with minimum efficiency of 0.91 UEF.

C406.2.7 Improved service hot water temperature maintenance. For buildings with gross floor area greater than 10,000 square feet, credit shall be achieved when hot water temperature maintenance is installed in accordance with Section C406.2.7.1 or C406.2.7.2.

C406.2.7.1 Self-regulated heat trace system. The credit achieved shall be from Table C406.2(1). This system shall include self-regulating electric heat cables, connection kits and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.7.2. Point of use water heater. The credit achieved shall be from Table C406.2(1) where any fixtures requiring hot water shall be supplied from a localized electric source of hot water with no recirculation or heat trace and limited to 2 kW and 6 gallons of storage. The supply pipe length from the point of use water heater to the termination of the fixture supply pipe shall be no more than 20 feet.

C406.2.8 Service hot water distribution right sizing. To achieve this credit, where Group ((~~R-1 and R-2~~)) occupancies are served by a central service hot water system, the distribution system serving *dwelling units* ((~~, *sleeping units* and guest-rooms~~)) shall be sized using Appendix M of the *Uniform Plumbing Code*.

SDCI Informative Note: Section C404.3.3 requires use of UPC Appendix M for determining demand load, and permits pipes to be one pipe size larger than the minimum determined using that demand load. However, this credit requires use of the minimum pipe sizes permitted by the demand load as determined using UPC Appendix M.

C406.2.9 High performance service hot water temperature maintenance system. Systems with multiple riser service hot water circulation systems shall use only heat pump technology for temperature maintenance. The heat pump technology shall have a minimum COP of 3.0 or UEF of 3.4. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering dry bulb air temperature of 60°F (16°C) or lower and a relative humidity of 50 percent or lower. For water-source equipment, the COP rating will be reported at the design leaving load side water temperature with an entering source side water temperature of 74°F (23°C) or lower. The system shall comply with the requirements of Section C404.7.1.

C406.2.10 High efficiency service hot water circulation system. Multiple riser service hot water circulation systems shall use a variable volume circulation pump controlled to vary the pump speed based on system demand and shall include self-actuated thermostatic balancing valves to control the system flow at each riser.

C406.2.11 Low flow showerheads for Group R-1 and R-2 occupancies. All showerheads installed in Group R-1 and R-2 *dwelling units* or *sleeping units* shall have a maximum listed flowrate of 1.25 gallons per minute or less at 80 psi operating pressure for fixed showerheads and a maximum listed flowrate of 1.50 gallons per minute or less at 80 psi operating pressure for handheld showerheads. When a shower is served by more than one showerhead, including handheld showerheads, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.25 gallons per minute or less for fixed or 1.5 gallons per minute or less for handheld, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

C406.2.12 Enhanced envelope performance. The Proposed Total UA of the thermal envelope of the project shall be 15 percent lower than the Allowable Total UA determined in accordance with Section C402.1.5 and Equation 4-2.

C406.2.13 Reduced air leakage. Energy credits shall be achieved where measured air leakage of the total *conditioned floor area* of the whole building, fully isolated building addition or tenant space is determined in accordance with Section C402.5.1.2 and complies with the maximum leakage in either Section C406.2.13.1 or C406.2.13.2.

C406.2.13.1 Base reduced air leakage. Measured air leakage shall not exceed 68 percent of the maximum leakage allowed by Section C402.5.1.2.

C406.2.13.2 Enhanced reduced air leakage. Measured air leakage shall not exceed 33 percent of the maximum leakage allowed by Section C402.5.1.2.

((~~**C406.2.14 Enhanced commercial kitchen equipment.** For buildings or areas designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:~~

~~1. Achieve the ENERGY STAR label in accordance with the specifications current as of January 1, 2022.~~

~~2. Be installed prior to the issuance of the certificate of occupancy.~~

~~3. Have the ENERGY STAR qualified model number listed on the construction documents submitted for permitting.~~

~~Energy efficiency credits for efficient commercial kitchen equipment shall be determined based on Equation 4-19, rounded to the nearest whole number.~~))

SDCI Informative Note: Energy Star commercial kitchen equipment is required for all commercial kitchen projects by Section C405.14.

C406.2.15 Residential kitchen equipment. For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where not less than 90 percent of dishwashers, refrigerators, and freezers comply with all of the following:

1. Achieve the ENERGY STAR Most Efficient label in accordance with the 2021 specifications.
2. Be installed prior to the issuance of the certificate of occupancy.

For Group R-1 where only some guestrooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Section C406.2.15 table credits] × [Floor area of guestrooms with kitchens] / [Total guestroom floor area]

C406.2.16 Residential laundry appliances. For projects with Group R-2 occupancies, energy credits shall be achieved where not less than 90 percent of clothes washers and dryers in the project meet the following requirements:

1. Each dwelling unit contains in-unit washing washer and dryer equipment that meets the following requirements:
   1.1. Achieve the ENERGY STAR Most Efficient label in accordance with the 2021 specifications.
   1.2. Be installed prior to the issuance of the certificate of occupancy.
2. Where only some dwelling units are equipped with both washers and dryers, the table credits shall be prorated as follows:

[Section C406.2.16 table credits] × [Floor area of dwelling units with laundry] / [Total dwelling unit floor area]

C406.2.17 Heat pump clothes dryers. Not less than 90 percent of domestic clothes dryers located in Group R-1 and R-2 of the whole project are ENERGY STAR rated heat pump dryers. Credit applies only to buildings where laundry facilities are provided either within each residential dwelling or sleeping units or grouped together in central multi-family use laundry rooms, or a mix of the two.

To claim this credit, the building permit drawings shall specify the appliance type and provide documentation of ENERGY STAR compliance. At the time of inspection, all appliances shall be installed and connected to utilities.

C406.2.18 Efficient elevator equipment. Qualifying elevators in the building shall be Energy Efficient Class A in accordance with ISO 25745-2, Table 7. Only buildings three or more floors above grade shall be permitted to use this credit. Credits shall be prorated based on Equation 4-18, rounded to the nearest whole credit. Projects with a compliance ratio (CR_e in Equation 4-18) below 0.5 do not qualify for this credit.

$$EC_e = EC_t \times CR_e \quad \textbf{(Equation 4-18)}$$

Where:

EC_e = Elevator energy credit achieved for building.
EC_t = Section C406.2.18 table energy credit.
$CR_e = \frac{F_A}{F_B}$
F_A = Sum of floors served by Class A elevators.
F_B = Sum of floors served by all building elevators and escalators.

C406.3 Load management credits. Load management measures installed in the building that meet the requirements in Sections C406.3.1 through C406.3.7 shall achieve the credits listed for the occupancy group in Table C406.3 or where calculations required by Sections C406.3.1 through C406.3.7 create or modify the table credits the credits achieved will be based upon the section calculations.

Each load management measure shall require automatic controls activated by either utility demand response, utility price response signal, peak price period time control, or local building demand monitoring. Controls shall be capable of and configured to provide the required load management sequences. As used in this section, "peak period" shall be either the coincident peak building load period, the peak price period, the peak utility load period, or the peak building demand period. The following additional requirements apply to these measures:

1. Where credit is taken for C406.3.6, service water heating energy storage, the equipment shall be provided with controls that comply with ANSI/CTA 2045-B.

2. For load management measures in Sections C406.3.1 through C406.3.5:
   2.1. Where the serving utility has a real-time demand response or pricing program, an interface compliant with serving utility requirements shall be installed.
   2.2. Where the serving utility does not have a real-time demand response or pricing program, a digital input to the system to support future utility programs shall be installed and building demand monitoring shall be installed and integrated into the load management sequence.
   2.3. All equipment involved in the required load management sequence shall have controls connected to a central DDC system.

Table C406.3
Load Management Measure Credits

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Lighting load management	C406.3.1	12	15	27	15	NA	NA
2. HVAC load management	C406.3.2	29	24	42	23	13	26
3. Automated shading	C406.3.3	NA	7	12	16	NA	NA
4. Electric energy storage	C406.3.4	41	50	126	72	37	65
5. Cooling energy storage	C406.3.5	13	10	14	19	NA	14
6. Service hot water energy storage	C406.3.6	31	248	59	8	5	70
7. Building thermal mass	C406.3.7	NA	NA	50	95	96	80

C406.3.1 Lighting load management. Automatic controls shall be capable of gradually reducing general lighting power with continuous dimming in 75 percent of the building area by at least 20 percent during peak demand periods. Where less than 75 percent, but at least 50 percent, of the building area lighting is controlled, the credits from Table C406.3 shall be prorated as follows:

$$\frac{[\textit{Area of building with lighting load management}, \%] \times [\textit{Table credits for } \text{C406.3.1}]}{75\%}$$

EXCEPTION: Warehouse or retail storage building areas shall be permitted to achieve this credit by switching off at least 25 percent of lighting power in 75 percent of the building area without dimming.

C406.3.2 HVAC load management. Automatic controls shall:

1. Where electric cooling is used, be configured to gradually increase, over a minimum of three hours, the cooling setpoint by at least 3°F during the summer peak periods.
2. Where electric heating is used, be configured to gradually reduce, over a minimum of three hours, the heating setpoint by at least 3°F during winter peak periods.

C406.3.3 Automated shading load management. Where fenestration on south and west exposures exceeds 20 percent of the wall area, automatic controls shall be configured to operate movable exterior shading devices or dynamic glazing to reduce solar gain through sunlit fenestration on southern and western exposures by at least 50 percent during summer peak periods.

Informative Note: This credit can be met by exterior roller, movable blind or movable shutter shading devices; however, fixed overhang, screen or shutter shading will not meet the requirement. Roller shades that reject solar gain but still allow a view are allowed as long as they provide an effective 50 percent reduction in net solar gain (e.g., have a shading coefficient of less than 0.5 for the shading material itself). Interior shading devices will not meet the requirement. Electrochromatic windows that achieve 50 percent of SHGC would qualify.

C406.3.4 Electric energy storage. Automatic controls shall store electricity in electric storage devices during nonpeak periods and use stored energy during peak periods. Electric storage devices shall have a minimum capacity of 5 Wh/ft^2 (58 Wh/m^2) of gross building area. For greater storage capacity up to 15 Wh/ft^2 (160 Wh/m^2), credits shall be prorated as follows:

$$[\text{Installed electric storage capacity, Wh/ft}^2]/5 \times [\text{C406.3.4 credits from Table C406.3}]$$

C406.3.5 Cooling energy storage. Automatic controls shall be capable of activating ice or chilled water storage to reduce peak period electric demand. Credits shown in Table C406.3 are based on storage capacity of 2 ton-hours per design day ton of cooling load (2 kWh per design day kW) with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 3.5 ton-hours per design day ton (kWh per design day kW) of cooling load rounded to the nearest whole credit. The storage tank shall have no more than 1.5 percent of storage capacity standby loss per day.

C406.3.6 Service hot water energy storage. To achieve this credit, where service hot water is heated by electricity, automatic controls shall preheat stored service hot water before the peak period and suspend electric water heating during the peak period. Storage capacity shall be provided by either:

1. Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water heating capacity. Tempering valves shall be provided at the water heater delivery location.
2. Providing additional heated water tank storage capacity above peak service hot water demand with equivalent peak storage capacity to item 1.

C406.3.7 Building thermal mass. To achieve this credit, the building shall have both additional passive interior mass and a night-flush control of the HVAC system.

1. Interior to the *building thermal envelope* insulation, provide 15 pounds of passive thermal mass per square foot of building floor area. Mass construction shall be in the building interior and the indoor facing portion of the exterior wall, and interior floor construction. Mass construction shall have mass surfaces in direct contact with the air in conditioned spaces with directly attached wall board or hard surface flooring allowed. Mass with carpet or furred wallboard shall not be counted toward the building mass required. For integral insulated concrete block walls complying with ASTM C90, only the mass of the interior face shall be counted toward the building mass required.
2. When summer mode is active and indoor average temperature is 5°F (3°C) or more above outdoor temperature and between 10:00 p.m. and 6:00 a.m., *automatic* night flush controls shall operate outdoor air economizers at low fan speed less than 66 percent during the unoccupied period until the average indoor air temperature falls to the occupied heating setpoint. Summer mode shall be activated when outdoor air exceeds 70°F (21°C) and continues until deactivated when outdoor air falls below 45°F (7°C). Another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating and is *approved* by the *code official*.

Informative Note: The simplified night flush sequence described will operate in "summer mode" below the 70°F outdoor air trigger temperature down until outdoor air of 45°F is hit when the "summer mode" is deactivated until the outdoor air temperature rises above 70°F again. Other strategies may be implemented that cool the space below the heating setpoint and adjust the morning heating setpoint to avoid morning reheating.

SECTION C407
TOTAL BUILDING PERFORMANCE

C407.1 Scope. This section establishes criteria for compliance using total building performance. All systems and loads shall be included in determining the total building performance including, but not limited to: Heating systems, cooling systems, service water heating, fan systems, lighting power, receptacle loads and process loads.

EXCEPTION: Energy used to recharge or refuel vehicles that are used for on-road and off-site transportation purposes.

C407.2 Mandatory requirements. Compliance with Section C407 also requires compliance with those sections shown in Table C407.2.

The building permit application for projects utilizing this method shall include in one submittal all building and mechanical drawings and all information necessary to verify that the building envelope and mechanical design for the project corresponds with the annual energy analysis. If credit is proposed to be taken for lighting energy savings, then an electrical permit application shall also be submitted and approved prior to the ((~~issuance of the building permit~~)) start of building construction. If credit is proposed to be taken for energy savings from other components, then the corresponding permit application (e.g., plumbing, boiler, etc.) shall also be submitted and approved prior to the building permit application. Otherwise, components of the project that would not be approved as part of a building permit application shall be modeled in the baseline in accordance with ANSI/ASHRAE/IESNA 90.1 Appendix G and in the proposed model in accordance with the requirements of the ((~~Washington State~~)) Seattle Energy Code.

Table C407.2
Mandatory Compliance Measures for Total Building Performance Method

Section[a]	Title	Comments
Envelope		
((~~C401~~)) C401.4	Thermal envelope certificate	
C402.2.7	Airspaces	
C402.5	Air leakage	
Mechanical		
C403.1.2	Calculation of heating and cooling loads	
C403.1.3	Data centers	

Table C407.2—continued
Mandatory Compliance Measures for Total Building Performance Method

Section[a]	Title	Comments
C403.2	System design	
C403.3.1	Equipment and system sizing	
C403.3.2	HVAC equipment performance requirements	
C403.3.3	Hot gas bypass limitation	
C403.3.4.4	Boiler turndown	
((~~C403.3.6~~	~~Ventilation for Group R occupancy~~))	
C403.4.1	Thermostatic controls	
C403.4.2	Off-hour controls	
C403.4.7	Combustion heating equipment controls	
C403.4.8	Group R-1 hotel/motel guestrooms	See Section C403.7.4
C403.4.9	Group R-2 and R-3 dwelling units	
C403.4.10	Group R-2 sleeping units	
C403.4.11	Direct digital control systems	
C403.5.5	Economizer fault detection and diagnostics (FDD)	
C403.7	Ventilation and exhaust systems	Except for C403.7.6.2
C403.8	Fan and fan controls	
C403.9.1.1	Variable flow controls	For cooling tower fans ≥ 7.5 hp
((~~C403.9.1.2~~)) C403.9.1.3	Limitation on centrifugal fan cooling towers	For open cooling towers
C403.10	Construction of HVAC elements	
C403.11	Mechanical systems located outside of the building thermal envelope	
C403.14	Commissioning	
Service Water Heating		
C404	Service water heating	Except for C404.2.1
Lighting and Electrical		
C405	Electrical power and lighting systems	
Other Requirements		
C407	Total building performance	
C408	System commissioning	
C409	Energy metering	
C410	Refrigeration requirements	
C411[b]	Renewable energy	
C412	Compressed air systems	

a Reference to a code section includes all the relative subsections except as indicated in the table.
b Compliance with any of these sections includes compliance with any exception to that section.

C407.3 Performance-based compliance. Compliance with this section requires compliance with ASHRAE Standard 90.1 Appendix G, Performance Rating Method, in accordance with Standard 90.1 Section 4.2.1 with the following modifications:

1. The mandatory requirements of the ((~~Washington State~~)) Seattle Energy Code are required to be met, instead of those of Section G1.2.1a of ANSI/ASHRAE/IESNA 90.1
2. Compliance with Section C407 requires meeting both a regulated site energy target and a total site energy reduction target in accordance with the following:
   2.1. Regulated site energy target. The regulated site energy target is focused on regulated load energy efficiency, thus shall be met only via regulated load savings without consideration of the contribution of on-site or off-site renewable energy or unregulated load savings. Adjustments to the PCI, to account for the contribution of renewable energy found in ANSI/ASHRAE/IESNA 90.1 Section 4.2.1.1 shall not be used. References to energy cost in Section 4.2.1.1 and Appendix G shall be replaced by site energy use. Heating or cooling energy provided by a district energy system may utilize coefficient of performance (COP) ratios acceptable to the *code official* for the respective district energy sources. The building performance factors in Table 4.2.1.1 of ANSI/ASHRAE/IESNA 90.1 shall be replaced with those in Table C407.3(2).

2.2. Total site energy target. The total site energy performance target shall be met including the contributions of on-site or off-site renewable energy as described in Section C411.2 as well as the contributions of improvements in unregulated loads as allowed by Section C407.3.4. The annual on-site and off-site renewable energy production (as adjusted by the factors in Table C411.2.1) shall be subtracted from the proposed building annual site energy use. Compliance with the site energy performance target requires that the proposed building site energy use/baseline building site energy use is less than or equal to the site energy performance target from Table C407.3(3).

3. Documentation requirements in Section G1.3.2.d shall be replaced by a list showing compliance with the mandatory provisions of Table C407.2.

4. Forms demonstrating compliance with Appendix G developed by the U.S. Department of Energy shall be completed and submitted to the *code official*. The forms are available at energycodes.gov/ashrae-standard-901-performance-based-compliance-form.

5. References to yet-to-be-designed future building components in the Proposed Building Performance column of Table G3.1 shall be modified to reference the corresponding sections of the ((~~Washington State~~)) Seattle Energy Code in lieu of the requirements of ANSI/ASHRAE/IESNA 90.1 in the following sections of the table:

   5.1. No. 1, Design Model, subclause c.

   5.2. No. 6, Lighting, subclause c.

   5.3. No. 11, Service Water Heating System, subclause c.

   5.4. No. 12, Receptacle and Other Loads, subclause b.

6. HVAC systems, subclauses c and d of Table G3.1, shall meet the following requirements:

   6.1. For yet-to-be-designed systems in office, retail, library, education, and multifamily buildings and occupancies subject to the TSPR requirements of Section C403.1.1, the system type and efficiency parameters in the proposed model shall meet but not exceed those shown in Table D602.11 Standard Reference Design HVAC Systems.

   6.2. For all other buildings and occupancies, the system type shall be the same as the system modeled in the baseline design and shall comply with but not exceed the requirements of Section C403 in lieu of ANSI/ASHRAE/IESNA 90.1.

   6.3. For HVAC systems serving future tenant spaces, where the current building permit applies to only a portion of an HVAC system, and future components will receive HVAC services from systems included in the current building permit, those future components shall be modeled as the type required to complete the HVAC system portions under the current permit and shall meet but not exceed the requirements found in Section C403.

7. The requirements for proposed and baseline building lighting system shall be modified in accordance with Addendum af to ANSI/ASHRAE/IESNA 90.1.

8. Energy modeler qualifications. The energy analyst in responsible charge of the Section C407 submittal shall meet at least one of the following:

   8.1. ASHRAE Building Energy Modeling Professional (BEMP) certification.

   8.2. Association of Energy Engineer's Building Energy Simulation Analyst (BESA) certification.

   8.3. Successful completion of at least five projects modeled following any version of ANSI/ASHRAE/IESNA 90.1 Appendix G within the last three years that were reviewed and approved by a *code official* or rating authority.

SDCI Informative Note: The permit applicant is encouraged to schedule a pre-application meeting to discuss the modeling approach for any yet-to-be designed areas that are not included in the C407 permit submissions. In general, future permit submissions should not contribute energy savings to the C407 submission beyond prescriptive code requirements, assuming use of the base building HVAC systems. Future systems must be modeled for the base building permit as being no better than the current prescriptive code, because plans often change and the City does not have a mechanism for ensuring that future tenant projects meet any beyond-code performance modeled in the original C407 submission.

Table C407.3(1)
((~~Carbon Emissions Factors~~)) Reserved

((~~Type~~	~~CO2e (lb/unit)~~	~~Unit~~
~~Electricity~~	~~0.44~~	~~kWh~~
~~Natural gas~~	~~11.7~~	~~Therm~~
~~Oil~~	~~19.2~~	~~Gallon~~
~~Propane~~	~~10.5~~	~~Gallon~~
~~Other*~~	~~195.00~~	~~mmBtu~~
On-site renewable energy	~~0.00~~))	

((~~*District energy systems may use alternative emissions factors supported by calculations approved by the *code official*.~~))

Table C407.3(2)
Building Performance Factors (BPF) to be used for Compliance with Section C407.3

Building Area Type	Building Performance Factor
Multifamily	((~~0.51~~)) 0.45
Health care/hospital	0.70
Hotel/motel	((~~0.51~~)) 0.46
Office	0.44
Restaurant	0.33
Retail	0.41
School	0.35
Warehouse	0.18
All others	0.43

Table C407.3(3)
Site Energy Performance Targets to be used for Compliance with Section C407.3

Building Area Type	Site Energy Performance Targets
Multifamily	((~~0.59~~)) 0.53
Health care/hospital	0.72
Hotel/motel	((~~0.62~~)) 0.56
Office	0.58
Restaurant	0.59
Retail	0.46
School	0.52
Warehouse	0.29
All others	0.55

C407.3.1 Limits on ((~~nonmandatory measures~~)) substandard building envelopes. The Proposed Total UA of the proposed building shall be no more than ((~~20~~)) 10 percent higher than the Allowed Total UA as defined in Section C402.1.5.

C407.3.2 On-site and off-site renewable energy accounting for use with Appendix G. Qualifying on-site and off-site renewable energy delivered or credited to the building project to comply with Section C407.3 item 2.2 shall meet the requirements of Section C411.2.

C407.3.3 Low-carbon district energy use with Appendix G. Qualifying *low-carbon district heating and cooling or heating only systems* and *low-carbon district energy exchange systems* shall meet the requirements of Section C407.3.3.1 or C407.3.3.2, as applicable.

C407.3.3.1 Utilization of low-carbon district heating and cooling or heating only systems. Applicable if heating and cooling or heating only is provided to the *proposed building* from a *low-carbon district heating and cooling or heating only system* that is fully operational prior to the final inspection. Proposed model shall account for all on-site HVAC and service hot water related equipment, such as circulation pump energy and heat-exchanger efficiency.

1. The following modifications shall be applied to Appendix G of ANSI/ASHRAE/IESNA 90.1 in addition to what is described in Section C407.3:

1.1. For low-carbon district heating and cooling systems, strike the text of Sections G3.1.1.1, G3.1.1.2, G3.1.1.3.1, G3.1.1.3.3, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4, comparing energy use to determine compliance.

1.2. For low-carbon district heating only systems, strike the text of Sections G3.1.1.1, G3.1.1.3.1, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4, ((~~with carbon emission factors from Table C407.3(1)~~)) comparing energy use to determine compliance.

2. Any heating or cooling energy provided by the *low-carbon district heating and cooling or heating only system* shall utilize a calculated energy use reduction factor acceptable to the code official to account for energy use reduction from those end uses.

3. Energy "credit" for any waste/recoverable heat exported to the *low-carbon district heating and cooling or heating only systems* shall be accounted for in the proposed design by multiplying the quantity of heat exported by the appropriate seasonal utilization factor in Items 3.1 and 3.2 below. This energy "credit" is subtracted from the total proposed design energy use calculated in accordance with ASHRAE 90.1 Section 4.2.1.1.

3.1. Fifty percent of the waste heat exported to the *low-carbon district heating and cooling or heating only systems* during the months of October through December and January through March.

3.2. Twenty-five percent of the waste heat exported to the *low-carbon district heating and cooling or heating only systems* during the months of April through September.

EXCEPTION: Waste heat exported from the building to the *low-carbon district heating and cooling or heating only system* shall not be subtracted from the proposed design energy use if they are already accounted for in the calculation of energy use from the district heating or cooling plant as part of the *district energy efficiency factor*.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate the following:

1. Distribution losses must be accounted for and may not exceed 10 percent of the annual load delivered to buildings served by the system.

2. Twenty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat or renewable energy resources and no more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources, or not more than 10 percent of the system annual heat input to the system comes from fossil fuel or electric-resistance sources.

C407.3.3.2 Utilization of low-carbon district energy exchange systems. Applicable if heating or cooling is provided to the *proposed building* from a *low-carbon district energy exchange system* that is fully operational prior to the final inspection. Proposed model shall account for all on-site HVAC and service hot water related equipment, such as circulation pump energy and heat-exchanger efficiency.

1. The following modifications shall be applied to Appendix G of ANSI/ASHRAE/IESNA 90.1 in addition to what is described in Section C407.3:

1.1. Strike the text of Sections G3.1.1.1, G3.1.1.2, G3.1.1.3, G3.1.1.3.1, G3.1.1.3.2, G3.1.1.3.3, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4.

2. Any heating or cooling energy provided by a low-carbon district energy exchange system shall utilize a calculated energy use reduction factor acceptable to the *code official* to account for the reduction in the proposed model.

3. Energy use "credit" for any waste/recoverable heating exported to the *low-carbon district energy exchange system* shall be accounted for in the proposed design by multiplying the quantity of heat exported by the appropriate seasonal utilization factor in Items 3.1 and 3.2 below. This energy use "credit" is subtracted from the total proposed design energy use calculated in accordance with ASHRAE 90.1 Section 4.2.1.1.

3.1. Fifty percent of the waste heat exported to the *low-carbon district energy exchange system* during the months of October through December and January through March.

3.2. Twenty-five percent of the waste heat exported to the *low-carbon district energy exchange system* during the months of April through September.

EXCEPTION: Waste heat exported from the building to the *low-carbon district heating and cooling or heating only system* shall not be subtracted from the proposed design energy use if they are already accounted for in the calculation of energy use from the district heating or cooling plant as part of the *district energy efficiency factor*.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of *low-carbon district energy exchange system* is satisfied.

C407.3.4 Credit for improvements in unregulated loads when using Appendix G. When calculating savings for site energy targets in accordance with Section C407.3 item 2.2, but not when calculating savings for ((~~emissions~~)) site energy targets in accordance with Section C407.3 item 2.1, differences in the simulation of unregulated loads and equipment modeled in the baseline building design from those in the *proposed design* shall be approved by the *code official* based on documentation that the equipment installed in the *proposed design* represents a significant verifiable departure from documented current conventional practice. All unregulated equipment for which savings is claimed must be installed by the time of final inspection. The burden of this documentation is to demonstrate that accepted conventional practice would result in baseline building equipment different from that installed in the *proposed design*. Occupancy and occupancy schedules shall not be changed.

C407.3.4.1 Approved unregulated load types. Unregulated load types for which reductions of energy use are claimed shall be one of those listed in Table C407.3.4.1 or shall be *approved* and publicly listed by SDCI. Requests for approval of such load types shall include the identification with predicted energy use of the baseline case in addition to the identification with predicted energy use of the proposed alternate. Listings for specific load types may be withdrawn and made unavailable for subsequent permit applications in cases by SDCI where it is considered that the unregulated load type listed has become accepted conventional practice. Unregulated load savings shall follow the methodology outlined in this section, and not use the language from Appendix G Table G3.1 - No. 12 Receptacle and Other Load Baseline Building Performance Exception.

Table C407.3.4.1
Approved Unregulated Load Types

In compliance with the requirements of section	Predicted energy reductions (%)	
	Group R-1	Group R-2
C406.2.15, Enhanced residential kitchen equipment	1.2	1.9
C406.2.16, Enhanced residential laundry equipment	N/A	0.6
C406.2.17, Heat pump clothes dryers	0.6	0.6

SECTION C408
SYSTEM COMMISSIONING

C408.1 General. A building commissioning process led by a *certified commissioning professional* and functional testing requirements shall be completed for mechanical systems in Section C403; service water heating systems in Section C404; controlled receptacle and lighting control systems in Section C405; equipment, appliances and systems installed to comply with Sections C406 or C407; energy metering in Section C409; and refrigeration systems in Section C410.

EXCEPTION: Buildings, or portions thereof, which are exempt from Sections C408.2 through C408.7 may be excluded from the commissioning process.

1. Mechanical systems that are not required to comply with Section C403.3.5 are exempt from the commissioning process where the installed total mechanical equipment capacity is less than 180,000 Btu/h (15 tons) cooling capacity and less than 240,000 Btu/h (20 tons) heating capacity and energy recovery ventilation (ERV) equipment is less than 300 cfm capacity.
2. Service water heating systems are exempt from the commissioning process in buildings where the largest service water heating system capacity is less than 200,000 Btu/h and where there are ((~~any~~)) none of the following:
   2.1. ((~~No~~)) pools or permanent spas.
   2.2. ((~~No~~)) solar thermal water heating.
   2.3. ((~~No~~)) recirculation pumps.
   2.4. ((~~No~~)) heat pump water heaters, except fully-packaged for individual residential dwelling unit use.
3. Lighting control systems are exempt from the commissioning process in buildings where both the total installed lighting load is less than 10 kW and the lighting load controlled by occupancy sensors or automatic daylighting controls is less than 5 kW.
4. Refrigeration systems are exempt from the commissioning process in buildings if they are limited to self-contained units.

C408.1.1 Commissioning in construction documents. Construction documents shall clearly indicate provisions for commissioning process. Electrical permit documents shall indicate required commissioning work for lighting and metering systems, and mechanical permit documents shall indicate required commissioning work for mechanical and water heating systems. The construction documents shall minimally include the following:

1. A narrative description of the activities that will be accomplished during the commissioning process. At a minimum, the commissioning process is required to include:
   1.1. Development and execution of the commissioning plan, including all subsections of Section C408.1.2;
   1.2. The *certified commissioning professional's* review of the building documentation and close out submittals in accordance with Section C103.6; and
   1.3. The commissioning report in accordance with Section C408.1.3.
2. Roles, responsibilities, and required qualifications of the *certified commissioning professional*.
3. A listing of the specific equipment, appliances, or systems to be tested.

C408.1.2 Commissioning plan. A commissioning plan shall be developed by the project's *certified commissioning professional*, shall be submitted to SDCI prior to the first mechanical inspection, and shall outline the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities, systems testing and balancing, functional performance testing, and verification of the building documentation requirements in Section C103.6.
2. Roles and responsibilities of the commissioning team, including the name and statement of qualifications of the *certified commissioning professional*.
3. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.

C408.1.2.1 In-house commissioning disclosure and conflict management plan. Where the *certified commissioning professional's* contract or employment is other than directly with the building owner, an in-house commissioning disclosure and conflict management plan shall be a part of the commissioning process. A copy shall be included in the commissioning plan. This plan shall disclose the *certified commissioning professional's* contractual relationship with other team members and provide a conflict management plan demonstrating that the *certified commissioning professional* is free to identify any issues discovered and report directly to the owner.

C408.1.2.2 Functional performance testing. Functional performance testing shall be conducted for mechanical systems in Sections C403; service water heating systems in Section C404; controlled receptacles and lighting control systems in Section C405; equipment, appliances, systems installed to comply with Section C406 or C407; energy metering in Section C409; and refrigeration systems in Section C410. Written procedures which clearly describe the individual systematic test procedures, the expected system response or acceptance criteria for each procedure, the actual response or findings, and any pertinent discussion shall be followed. This testing shall include control systems which will be tested to document that control devices, components, equipment, and systems are calibrated and adjusted to operate in accordance with approved construction documents. Testing shall affirm the conditions required within Sections C408.2 through C408.7 under system testing.

C408.1.2.3 Functional performance testing - Sampling. For projects with 7 or fewer similar systems, each system shall be tested. For projects with more than 7 systems, testing shall be done for each unique combination of control types. Where multiples of each unique combination of control types exist, no fewer than 20 percent of each combination shall be tested unless the code official or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested system fail, all remaining identical combinations shall be tested.

C408.1.2.4 Deficiencies. Deficiencies found during testing shall be resolved including corrections and retesting.

C408.1.3 Commissioning report. A commissioning report shall be completed and certified by the *certified commissioning professional* and delivered to the building owner or owner's authorized agent. The report shall be organized with mechanical, service water heating, controlled receptacle and lighting control systems, energy metering, and refrigeration findings in separate sections to allow independent review. The report shall record the activities and results of the commissioning process and be developed from the final commissioning plan with all of its attached appendices. The report shall be submitted to SDCI prior to the final inspection and shall include:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.
4. Commissioning plan.
5. Testing, adjusting and balancing report.

EXCEPTION: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

C408.1.4 Commissioning process completion requirements. Prior to the final mechanical, plumbing and electrical inspections or obtaining a certificate of occupancy, the *certified commissioning professional* shall provide evidence of *building commissioning* in accordance with the provisions of this section.

C408.1.4.1 Commissioning compliance. ((~~Buildings, or portions thereof, shall not be considered acceptable for a final inspection pursuant to Section C104.2.6 until the code official has received a letter of transmittal from the building owner acknowledging that the building owner or owner's authorized agent has received the Commissioning Report. Completion of Commissioning Compliance Checklist (Figure C408.1.4.1) is deemed to satisfy this requirement. Phased acceptance of Commissioning Compliance Checklist for portions of the work specific to the trade that is being inspected is permissible where accepted by the code official and where the certified commissioning professional remains responsible for completion of the commissioning process. If there are unresolved deficiencies when the final inspection is scheduled, the Commissioning Report shall be submitted and shall describe the unresolved deficiencies.~~

~~**C408.1.4.2 Copy of report.** The code official shall be permitted to require that a copy of the Commissioning Report be made available for review by the code official.~~))

The mechanical and water heating portions of the commissioning report, in compliance with Sections C408.2, C408.3, and C408.7, shall be submitted to SDCI prior to completion and approval of mechanical permit final inspection.

The controlled receptacle, lighting, and metering portions of the commissioning report, in compliance with Sections C408.4 and C408.6, shall be submitted to SDCI prior to completion and approval of electrical permit *final inspection*.

The following items shall be submitted to SDCI prior to completion and approval of *final inspection* as per Seattle Building Code Section 108.9.10 to demonstrate commissioning compliance:

1. Full commissioning report, in compliance with Section C408.1.3.
    a. The commissioning report shall include a list of all unresolved deficiencies and any incomplete commissioning work required by Section C408, with description and anticipated date of completion for each, or a statement signed by the *certified commissioning professional* attesting to successful commissioning of the entire project with no unresolved deficiencies or incomplete tests.
    b. Where tenant spaces will be built out under separate permits, the commissioning report shall describe the *certified commissioning professional's* scope of work required to complete commissioning of the central building HVAC systems and lighting control systems as the tenant spaces are completed.
2. Commissioning checklist, from Figure C408.1.4.1, signed by the *certified commissioning professional*.
3. Statement that the owner has received a copy of the commissioning report, signed by the owner or owner's authorized agent.

C408.1.4.1.1 Post-occupancy commissioning completion. Where there are unresolved deficiencies or other incomplete commissioning tasks that conflict with requirements of this code, the applicant shall comply with the requirements of one of the following three options.

1. In addition to the Temporary Certificate of Occupancy requirements of SBC 109.4, SDCI may issue a temporary certificate of occupancy (TCO) to remain in effect pending resolution of commissioning issues. Applicant must complete all outstanding commissioning work and complete a revised commissioning report before SDCI will issue a final Certificate of Occupancy.
2. Applicant must post a performance bond in the amount of 2 percent of the building permit project valuation as determined in accordance with the *fee subtitle*, to ensure completion of the required commissioning work within 12 months.
3. Applicant must obtain electrical and mechanical permits as required to incorporate all remaining electrical and mechanical work, including required commissioning of those systems. Applicant must complete all outstanding electrical and mechanical commissioning work and complete a revised commissioning report prior to completion and approval of final inspection for those permits.

SDCI Informative Note: An electronic version of the Commissioning Compliance Checklist is available on the SDCI Seattle Energy Code web page.

C408.2 Mechanical systems commissioning. Mechanical equipment and controls subject to Section C403 shall be included in the commissioning process required by Section C408.1. The commissioning process shall minimally include all energy code requirements for which the code states that equipment or controls shall "be capable of" or "configured to" perform specific functions.

Exception: Mechanical systems are exempt from the commissioning process where the installed total mechanical equipment capacity is less than ((~~240,000~~)) 180,000 Btu/h cooling capacity and less than ((~~300,000~~)) 240,000 Btu/h heating capacity, and energy recovery ventilation (ERV) equipment is less than 300 cfm capacity.

C408.2.1 Reserved.

C408.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the project specifications. Test and balance activities shall include air system and hydronic system balancing.

C408.2.2.1 Air systems balancing. Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers used for air system balancing are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (0.74 kW), fan speed shall be adjusted to meet design flow conditions.

EXCEPTION: Fans with fan motors of 1 hp (0.74 kW) or less.

C408.2.2.2 Hydronic systems balancing. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

EXCEPTION: The following equipment is not required to be equipped with means for balancing or measuring flow:

1. Pumps with pump motors of 5 hp (3.7 kW) or less.
2. Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

C408.2.3 System testing. Functional performance testing shall demonstrate the components, systems, and system-to-system interfacing relationships are installed and operate in accordance with *approved* construction documents. Testing shall include the *sequence of operation*, and be conducted under full-load, part-load and the following conditions:

1. All modes as described in the *sequence of operation*;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

C408.3 Service water heating systems commissioning. Service water heating equipment and controls subject to Section C404 shall be included in the commissioning process required by Section C408.1. The commissioning process shall minimally include equipment and components installed to meet all energy code requirements for devices to "start," "automatically turn off," "automatically adjust," "limit operation," and "limit the temperature" and "be configured to."

C408.3.1 System testing. Functional performance testing shall demonstrate that heaters, piping, distribution systems, and system-to-system interfacing relationships are installed and operate in accordance with *approved* construction documents. Testing shall include the *sequence of operation*, and be conducted under at least 50 percent water heating load, part-load and the following conditions:

1. Normal operation;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

C408.4 Controlled receptacle and lighting control system commissioning. *Controlled receptacles* and lighting control systems subject to Section C405 shall be included in the commissioning process required by Section C408.1. The configuration and function of *controlled receptacles* and lighting control systems required by this code shall be tested and shall comply with Section C408.4.1.

EXCEPTION: Lighting control systems and *controlled receptacles* are exempt from the commissioning process in buildings where:

1. The total installed lighting load is less than 20 kW, and
2. The lighting load controlled by occupancy sensors or *automatic* daylighting controls is less than 10 kW.

C408.4.1 System testing. Functional performance testing shall demonstrate that occupant sensors, time switches, manual overrides, ((~~night sweep-off~~)) time switch scheduled lighting shutoff, *daylight responsive control*, and *controlled receptacles* are installed and operate in accordance with *approved* construction documents. Testing shall include the *sequence of operation* and be conducted under the following conditions:

1. Normal operation;
2. Redundant or *automatic* back-up mode;

3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

C408.5 Systems installed to meet Section C406 or C407. Equipment, components, controls or configuration settings for systems which are included in the project to comply with Section C406 or C407 shall be included in the commissioning process required by Section C408.1.

C408.5.1 System testing. Functional performance testing for these appliances, equipment, components, controls and/or configuration settings shall demonstrate operation, function and maintenance serviceability for each of the commissioned systems in accordance with the *approved* construction documents.

C408.6 Metering system commissioning. Energy metering systems required by Section C409 shall comply with Section C408.6 and be included in the commissioning process required by Section C408.1. The commissioning process shall include all energy metering equipment and controls required by Section C409.

C408.6.1 System testing. Functional performance testing shall demonstrate that energy source meters, end-use meters, *data acquisition systems*, and energy displays are installed and operate in accordance with *approved* construction documents. At a minimum, testing shall confirm that:

1. The metering system devices and components work properly under low and high load conditions.
2. The metered data is delivered in a format that is compatible with the data collection system.
3. The energy display is in a location with *access* to building operation and management personnel.
4. The energy display meets code requirements regarding views required in Section C409.4.3. The display shows energy data in identical units (e.g., kWh).

C408.7 Refrigeration system commissioning. All installed refrigeration systems subject to Section C410 shall be included in the commissioning process required by Section C408.1.

EXCEPTIONS:

1. Self-contained refrigeration systems are exempt from the commissioning process.
2. Total installed capacity for refrigeration is equal to or less than 240 kBtu/h.

C408.7.1 System Testing. Functional performance testing shall demonstrate that compressors, heat exchangers, piping, distribution systems, and system-to-system interfacing relationships are installed and operate in accordance with *approved* construction documents. Testing shall include the *sequence of operation* and be conducted under full-load at, part-load and the following conditions:

1. Normal mode;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

SECTION C409
ENERGY METERING AND ENERGY CONSUMPTION MANAGEMENT

C409.1 General. All new buildings and additions shall have the capability of metering all source energy usage in accordance with Section C409.2 in addition to the source energy for on-site renewable energy production in accordance with Section C409.2.4 and the end-use energy usage for electric vehicle charging in accordance with Section C409.3.4. New buildings and additions with a gross conditioned floor area over ((~~25,000~~)) 20,000 square feet shall comply with Sections C409.2, C409.3, and C409.4. New buildings and additions shall be equipped to measure, monitor, record and display energy consumption data for each energy source and end use category per the provisions of this section, to enable effective energy management. Existing buildings shall comply with the energy metering provisions of Section C506.1. For Group R-2 buildings, the floor area of *dwelling units* shall be excluded from the total *conditioned floor area* for the purposes of determining the 20,000 square foot threshold. *Alterations* and *additions* to existing buildings shall conform to Section C506.

EXCEPTIONS:

1. Tenant spaces smaller than ((~~25,000~~)) 20,000 ft^2 square feet within buildings if the tenant space has its own utility service and utility meters shall comply with Section C409.2 and are exempt from the end-use metering, measurement devices, data acquisition system and energy display requirements of Sections C409.3 and C409.4, but are not exempt from the electric vehicle charging end-use metering requirements of C409.3.4.
2. Buildings in which there is no gross conditioned floor area over ((~~25,000~~)) 10,000 square feet, including building common area, that is served by its own utility services and meters shall comply with Section C409.2 and are exempt from the end-use metering, measurement devices, data acquisition system and energy display requirements of

Sections C409.3 and C409.4, but are not exempt from the electric vehicle charging end-use metering requirements of C409.3.4.

3. Group R-2 buildings with more than 20,000 square feet of conditioned floor area not occupied by dwelling units, and not exempt from end-use metering in accordance with Exception 1 of C409.1, are permitted to provide 0.12 watts of renewable energy per square foot of gross conditioned floor area, or 15 additional C406 credits, in lieu of the end-use metering systems required by this section. The renewable energy or C406 credits provided must be in addition to the renewable energy and C406 credits required cumulatively by all other sections of this code. Common areas in Group R-2 buildings using this exception are exempt from the end-use metering, measurement device, data acquisition system, and energy display requirements of Section C409.3 and C409.4, but not exempt from the electrical vehicle charging end-use metering requirements of C409.3.4.

SDCI Informative Note: Seattle's "Building Tune-ups" ordinance will continue to be in effect, requiring buildings with over 50,000 square feet of *conditioned floor area* to periodically assess and optimize the functioning of energy-consuming systems. The cost and complexity of these tune-ups can potentially be minimized by careful configuration of the metering system.

C409.1.1 Alternate metering methods. Where approved by the building official, energy use metering systems may differ from those required by this section, provided that they are permanently installed and that the source energy measurement, end use category energy measurement, data storage and data display have similar accuracy to and are at least as effective in communicating actionable energy use information to the building management and users, as those required by this section.

C409.1.2 Conversion factor. Any threshold stated in kW shall include the equivalent BTU/h heating and cooling capacity of installed equipment at a conversion factor of 3,412 Btu per kW or 2,730 Btu per kVA.

C409.1.3 Dwelling units. See Sections C404.9 and C405.7 for additional metering requirements for Group R-2 dwelling units.

C409.2 Energy source metering. Buildings shall have a meter at each energy source. For each energy supply source listed in Section C409.2.1 through C409.2.4, meters shall collect data for the whole building or for each separately metered portion of the building where not exempted by the exceptions to Section C409.1.

Exceptions:

1. Energy source metering is not required where end use metering for an energy source accounts for all usage of that energy type within a building, and the *data acquisition system* accurately totals the energy delivered to the building or separately metered portion of the building.
2. Solid fuels such as coal, firewood or wood pellets that are delivered via mobile transportation do not require metering.

C409.2.1 Electrical energy. This category shall include all electrical energy supplied to the building and its associated site, including site lighting, parking, recreational facilities, and other areas that serve the building and its occupants.

EXCEPTION: Where site lighting and other exterior non-building electrical loads are served by an electrical service and meter that are separate from the building service and meter, the metering data from those loads is permitted to be either combined with the building's electrical service load data or delivered to a separate *data acquisition system*.

C409.2.2 Gas and liquid fuel supply energy. This category shall include all natural gas, fuel oil, propane and other gas or liquid fuel energy supplied to the building and site.

C409.2.3 District energy. This category shall include all net energy extracted from district steam systems, district chilled water loops, district hot water systems, or other energy sources serving multiple buildings.

C409.2.4 Site-generated renewable energy. This category shall include all net energy generated from on-site solar, wind, geothermal, tidal or other natural sources, and waste heat reclaimed from sewers or other off-site sources. For buildings exempt from data collection systems, the data from these meters is permitted to either be stored locally using a manual totalizing meter or other means at the meter or fed into a central data collection system.

C409.3 End-use metering. Meters shall be provided to collect energy use data for each end-use category listed in Sections C409.3.1 through C409.3.7. These meters shall collect data for the whole building or for each separately metered portion of the building where not exempted by the exception to Section C409.1. Not more than 10 percent of the total connected load of any of the end-use metering categories in Sections C409.3.1 through C409.3.6 is permitted to be excluded from that end-use data collection. Not more than 10 percent of the total connected load of any of the end-use metering categories in Sections C409.3.1 through C409.3.6 is permitted to consist of loads not part of that category. Multiple meters may be used for any end-use category, provided that the *data acquisition system* totals all of the energy used by that category. Full-floor tenant space submetering data shall be provided to the tenant in accordance with Section C409.7, and the data shall not be required to be included in other end-use categories.

EXCEPTIONS:

1. HVAC and service water heating equipment serving only an individual *dwelling unit* or sleeping unit does not require end-use metering.
2. Separate metering is not required for fire pumps, stairwell pressurization fans or other life safety systems that operate only during testing or emergency.
3. End use metering is not required for individual tenant spaces not exceeding 2,500 square feet in floor area when a dedicated source meter meeting the requirements of Section C409.4.1 is provided for the tenant space.
4. Healthcare facilities with loads in excess of 150 kVA are permitted to have submetering that measures electrical energy usage in accordance with the normal and essential electrical systems as identified in Section 517 of the Seattle Electrical Code except that submetering is required for the following load categories:
   4.1. HVAC system energy use in accordance with the requirements of Section C409.3.1.
   4.2. Service water heating energy use in accordance with the requirements of Section C409.3.2.
   4.3. Process load system energy in accordance with the requirements of Section ((~~C409.3.5~~)) C409.3.6 for each significant facility not used in direct patient care, including but not limited to, food service, laundry and sterile processing facilities, where the total connected load of the facility exceeds 100 kVA.
5. End-use metering is not required for electrical circuits serving only ((~~land~~)) hotel rooms and guest suites within Group R-1 occupancies. This exception does not apply to common areas or to equipment serving multiple sleeping rooms.

C409.3.1 HVAC system energy use. This category shall include all energy including electrical, gas, liquid fuel, district steam and district chilled water that is used by boilers, chillers, pumps, fans and other equipment used to provide space heating, space cooling, dehumidification and ventilation to the building, but not including energy that serves process loads, service water heating or miscellaneous loads as defined in Section C409.3. Multiple HVAC energy sources, such as gas, electric and steam, are not required to be summed together.

EXCEPTIONS:

1. 120 volt equipment.
2. An HVAC branch circuit where the total MCA of equipment served equates to less than 10 kVA.
3. Individual fans or pumps that are not on a variable frequency drive.

C409.3.2 Service water heating energy use. This category shall include all energy used for heating of domestic and service hot water, but not energy used for space heating.

EXCEPTION: Service water heating energy use less than 50 kVA does not require end-use metering.

C409.3.3 Lighting system energy use. This category shall include all energy used by interior and exterior lighting, including lighting in parking structures and lots, but not including plug-in task lighting.

C409.3.4 Electric vehicle charging energy use. This category shall include all energy used for electrical vehicle charging. For buildings exempt from data collection systems, the data from these meters is permitted to either be stored locally using a manual totalizing meter or other means at the meter or fed into a central data collection system.

C409.3.5 Plug load system energy use. This category shall include all energy used by appliances, computers, plug-in task lighting, and other equipment or equipment covered by other end-use metering categories listed in Section C409.3. In a building where the main service is 480/277 volt, each 208/120 volt panel is permitted to be assumed to serve only plug load for the purpose of Section C409, unless it serves nonresidential refrigeration or cooking equipment.

EXCEPTIONS:

1. Where the total connected load of all plug load circuits is less than 50 kVA, end-use metering is not required.
2. Electric receptacles located in fire-rated or smoke-rated corridors, enclosed stairwells, or egress passageways are not required to be metered.

C409.3.6 Process load system energy use. This category shall include all energy used by any non-building process load, including but not limited to nonresidential refrigeration and cooking equipment, laundry equipment, industrial equipment and stage lighting.

EXCEPTION: Where the process load energy use is less than 50 kVA, end-use metering is not required.

C409.3.7 Full-floor tenant space electrical submetering. In a multi-tenant building where more than 90 percent of the leasable area of a floor is occupied by a single tenant, an electrical energy use display shall be provided to the tenant in accordance with the requirements of Section C409.4.3. Electrical loads from areas outside of the tenant space or from equipment that serves areas outside of the tenant space shall not be included in the tenant space submetering. A single display is permitted to serve multiple floors occupied by the same tenant.

C409.4 Measurement devices, data acquisition system and energy display.

C409.4.1 Meters. Meters and other measurement devices required by this section shall be configured to automatically communicate energy data to a data acquisition system and energy display. Source meters may be any digital-type meters. Current sensors or flow meters are allowed for end use metering, provided that they have an accuracy of +/- 5%. All required metering systems and equipment shall provide data that is fully integrated into the data acquisition and display system per the requirements of Section C409. Electrical meters shall be configured to communicate data to the data acquisition system and energy display for both consumption (e.g., kWh) and consumption rate (e.g., kW). Other meters and measurement devices shall be configured to communicate data to the data acquisition system for consumption.

EXCEPTION: Where site lighting and other exterior non-building electrical loads are served by an electrical service and meter that are separate from the building service and meter, the metering data from those loads is permitted to be either combined with the building's electrical service load data or delivered to a separate *data acquisition system*.

C409.4.2 Data acquisition system. The data acquisition system shall store the data from the required meters and other sensing devices in a single database for a minimum of 36 months. For each energy supply and end use category required by C409.2 and C409.3, it shall provide energy consumption logged in one-hour or less intervals and energy consumption rate logged in 10-minute or less intervals. Data from the data acquisition system shall be viewable via the energy display in accordance with the requirements of Section C409.4.3.

C409.4.3 Energy display. For each building subject to Section C409.2 and C409.3, either a single visible display in a location with *ready access*, or a single web page or other electronic document available for access to building operation and management personnel or to a third-party energy data analysis service shall be provided in the building; for metering data acquisition systems and energy displays monitored by a third-party energy data analysis service, building operation and management personnel shall retain access to the metering data acquisition system and energy display. The display shall numerically provide the current energy consumption rate and energy consumption total for each whole building energy source and each end use category. The energy display shall also graphically and numerically display logged data from the data acquisition system for energy consumption for each whole building energy source and energy consumption rate for whole building electrical use and each end use category for any selected day, week, month, or year.

C409.4.4 Commissioning. Energy metering and energy consumption management systems shall be commissioned in accordance with Section C408.6.

SECTION C410
REFRIGERATION SYSTEM REQUIREMENTS

C410.1 General. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers, refrigerated warehouse freezers, and refrigerated display cases shall comply with this Section. Where they comprise any portion of the thermal envelope of the building, they shall also comply with the requirements of Section C402, using the R-values or U-values listed in this Section C410. Section C402.1.5 component performance alternative is permitted to be used for the thermal envelope of the refrigerated space where *approved* by the *code official*.

C410.2 Commercial refrigerators, freezers and refrigerator-freezers. Refrigeration equipment, defined in DOE 10 C.F.R. Part 431.62, shall have an energy use in kWh/day not greater than the values of Table C410.2 when tested and rated in accordance with AHRI Standard 1200. The energy use shall be verified through certification under an approved certification program or, where a certification program does not exist, the energy use shall be supported by data furnished by the equipment manufacturer.

C410.2.1 Refrigerated display cases. Refrigerated display cases shall comply with the following:

1. Lighting in refrigerated display cases shall be controlled by one of the following:
   1.1. Time switch controls to turn off lights during nonbusiness hours. Timed overrides for display cases shall turn the lights on for up to 1 hour and shall automatically time out to turn the lights off.
   1.2. Motion sensor controls on each display case section that reduce lighting power by at least 50 percent within 3 minutes after the area within the sensor range is vacated.
2. Low-temperature display cases shall incorporate temperature-based defrost termination control with a time-limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.
3. Antisweat heater controls shall reduce the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

C410.3 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers. Site-assembled and site-constructed *walk-in coolers* and *walk-in freezers* and *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with the following:

1. Automatic door-closers shall be provided that fully close walk-in doors that have been closed to within 1 inch (25 mm) of full closure.

   EXCEPTION: Automatic closers are not required for doors more than 45 inches (1143 mm) in width or more than 7 feet (2134 mm) in height.
2. Doorways shall be provided with strip doors, curtains, spring-hinged doors or other method of minimizing infiltration when doors are open.
3. *Walk-in coolers* and *refrigerated warehouse coolers* shall be provided with wall, ceiling, and door insulation of not less than R-25 or have wall, ceiling and door assembly *U*-factors no greater than *U*-0.039. *Walk-in freezers* and *refrigerated warehouse freezers* shall be provided with wall, ceiling and door insulation of not less than R-32 or have wall, ceiling and door assembly *U*-factors no greater than *U*-0.030.

   EXCEPTION: Insulation is not required for glazed portions of doors or at structural members associated with the walls, ceiling or door frame.
2. The floor of *walk-in coolers* shall be provided with floor insulation of not less than R-25 or have a floor assembly *U*-factor no greater than *U*-0.40. The floor of *walk-in freezers* shall be provided with floor insulation of not less than R-28 or have a floor assembly *U*-factor no greater than *U*-0.035.

   EXCEPTION: Insulation is not required in the floor of a *walk-in cooler* that is mounted directly on a slab on grade.
5. Transparent fixed window and reach-in doors for *walk-in freezers* and windows in *walk-in freezer* doors shall be provided with triple-pane glass, with the interstitial spaces filled with inert gas or be provided with heat-reflective treated glass.
6. Transparent fixed window and reach-in doors for *walk-in coolers* and windows for *walk-in coolers* doors shall be provided with double-pane or triple-pane glass, with interstitial space filled with inert gas, or be provided with heat-reflective treated glass.
7. Evaporator fan motors that are less than 1 hp (0.746 kW) and less than 460 volts shall be provided with electronically commutated motors, brushless direct-current motors, or 3-phase motors.
8. Condenser fan motors that are less than 1 hp (0.746 kW) shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.
9. Antisweat heaters that are not provided with antisweat heater controls shall have a total door rail, glass and frame heater power draw of not greater than 7.1 W/ft^2 (76 W/m^2) of door opening for *walk-in freezers* and not greater than 3.0 W/ft^2 (32 W/m^2) of door opening for *walk-in coolers*.
10. Where antisweat heater controls are provided, they shall be capable of reducing the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.
11. Lights in *walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall either be provided with light sources with an efficacy of not less than 40 lumens per watt, including ballast losses, or shall be provided with a device that automatically turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer space* is not occupied.

12. Evaporator fans in refrigerated warehouses shall be variable speed, and the speed shall be controlled in response to space conditions.

    EXCEPTION: Evaporators served by a single compressor without unloading capability.

13. Where they comprise any portion of the thermal envelope of the building, the floor, wall, and ceiling components shall also comply with the requirements of Section C402, using the R-values or U-values listed in this Section C410.2. Section C402.1.5 component performance alternative is permitted to be used where *approved* by the *code official*.

C410.3.1 Performance standards. Site-assembled and site-constructed *walk-in coolers* and *walk-in freezers* shall meet the requirements of Tables C410.3.1(1), C410.3.1(2), and C410.2.1(3).

Table C410.3.1(1)
Walk-in Cooler and Freezer Display Doors Efficiency Requirements

Class Description	Class	Maximum Energy Consumption (kWh/day)[a]
Display door, medium temperature	DD, M	$0.04 \times A_{dd} + 0.41$
Display door, low temperature	DD, L	$0.15 \times A_{dd} + 0.29$

a A_{dd} is the surface area of the display door.

Table C410.3.1(2)
Walk-in Cooler and Freezer Nondisplay Doors Efficiency Requirements

Class Description	Class	Maximum Energy Consumption (kWh/day)[a]
Passage door, medium temperature	PD, M	$0.05 \times A_{nd} + 1.7$
Passage door, low temperature	PD, L	$0.14 \times A_{nd} + 4.8$
Freight door, medium temperature	FD, M	$0.04 \times A_{nd} + 1.9$
Freight door, low temperature	FD, L	$0.12 \times A_{nd} + 5.6$

a A_{nd} is the surface area of the display door.

Table C410.3.1(3)
Walk-in Cooler and Freezer Refrigeration Systems Efficiency Requirements

Class Description	Class	Minimum Annual Walk-in Energy Factor AWEF (Btu/hW-h)	Test Procedure
Dedicated condensing, medium temperature, indoor system	DC.M.I	5.61	AHRI 1250
Dedicated condensing, medium temperature, outdoor system	DC.M.O	7.60	
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.I, < 6,500	$9.091 \times 10^{-5} \times q_{net} + 1.81$	
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) ≥ 6,500 Btu/h	DC.L.I, ≥ 6,500	2.40	
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.O, < 6,500	$9.091 \times 10^{-5} \times q_{net} + 2.73$	
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) ≥ 6,500 Btu/h	DC.L.O, ≥ 6,500	3.15	
Unit cooler, medium	UC.M	9.00	
Unit cooler, low temperature, net capacity (q_{net}) < 15,500 Btu/h	UC.L, < 15,500	$9.091 \times 10^{-5} \times q_{net} + 2.73$	
Unit cooler, low temperature, net capacity (q_{net}) ≥ 15,500 Btu/h	UC.L, ≥ 15,500	4.15	

C410.4 Refrigerated case and walk-in display doors. Lighting in glass doors in all *walk-in coolers* and *walk-in freezers* and all *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with the following:

1. Time switch controls to turn off lights during nonbusiness hours. Timed overrides for display cases shall turn the lights on for up to 1 hour and shall automatically time out to turn the lights off.

2. Motion sensor controls on each display case section that reduce lighting power by at least 50 percent within 3 minutes after the area within the sensor range is vacated.

C410.5 Refrigeration systems. Refrigerated display cases, *walk-in coolers* or *walk-in freezers* that are served by remote compressors and remote condensers not located in a *condensing unit*, shall comply with Sections C410.5.1, C410.5.2, and C403.9.2.3.

EXCEPTION: Systems where the working fluid in the refrigeration cycle goes through both subcritical and supercritical states (transcritical) or that use ammonia refrigerant are exempt.

C410.5.1 Condensers serving refrigeration systems. Fan-powered condensers shall comply with the following:

1. The design *saturated condensing temperatures* for air-cooled condensers shall not exceed the design dry-bulb temperature plus 10°F (5.6°C) for *low-temperature refrigeration systems*, and the design dry-bulb temperature plus 15°F (8°C) for *medium temperature refrigeration systems* where the *saturated condensing temperature* for blend refrigerants shall be determined using the average of liquid and vapor temperatures as converted from the condenser drain pressure.
2. Condenser fan motors that are less than 1 hp (0.75 kW) shall use electronically commutated motors, permanent split-capacitor-type motors or 3-phase motors.
3. Condenser fans for air-cooled condensers, evaporatively cooled condensers, air- or water-cooled fluid coolers or cooling towers shall reduce fan motor demand to not more than 30 percent of design wattage at 50 percent of design air volume, and incorporate one of the following continuous variable speed fan control approaches:
   3.1. Refrigeration system condenser control for air-cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient dry-bulb temperature.
   3.2. Refrigeration system condenser control for evaporatively cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient wet-bulb temperature.
4. Multiple fan condensers shall be controlled in unison.
5. The minimum condensing temperature setpoint shall be not greater than 70°F (21°C).

C410.5.2 Compressor systems. Refrigeration compressor systems shall comply with the following:

1. Compressors and multiple-compressor system suction groups shall include control systems that use floating suction pressure control logic to reset the target suction pressure temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

   EXCEPTION: Controls are not required for the following:

   1. Single-compressor systems that do not have variable capacity capability.
   2. Suction groups that have a design saturated suction temperature of 30°F (-1.1°C) or higher, suction groups that comprise the high stage of a two-stage or cascade system, or suction groups that primarily serve chillers for secondary cooling fluids.
2. Liquid subcooling shall be provided for all low-temperature compressor systems with a design cooling capacity equal to or greater than 100,000 Btu/hr (29.3 kW) with a design-saturated suction temperature of -10°F (-23°C) or lower. The subcooled liquid temperature shall be controlled at a maximum temperature setpoint of 50°F (10°C) at the exit of the subcooler using either compressor economizer (interstage) ports or a separate compressor suction group operating at a saturated suction temperature of 18°F (-7.8°C) or higher.
   2.1. Insulation for liquid lines with a fluid operating temperature less than 60°F (15.6°C) shall comply with Table C403.2.10.
3. Compressors that incorporate internal or external crankcase heaters shall provide a means to cycle the heaters off during compressor operation.
4. Compressor systems utilized in refrigerated warehouses shall conform to the following:
   4.1. Compressors shall be designed to operate at a minimum condensing temperature of 70°F or less.
   4.2. The compressor speed of a screw compressor greater than 50 hp shall be controllable in response to the refrigeration load or the input power to the compressor shall be controlled to use no more than 60 percent of full load input power when operated at 50 percent of full refrigeration capacity.

      EXCEPTION: Refrigeration plants with more than one dedicated compressor per suction group.

C410.6 Commissioning. Refrigeration systems shall be commissioned in accordance with Section C408.

EXCEPTION: Self-contained units.

SECTION C411
RENEWABLE ENERGY

C411.1 On-site renewable energy. Each new building ((~~,~~)) or addition, larger than ((~~10,000~~)) 5,000 square feet of *gross conditioned floor area*, shall include a renewable energy generation system consisting of not less than 0.5 W/ft^2 or 1.7 Btu/ft^2 multiplied by the sum of the *gross conditioned floor area*.

EXCEPTIONS:

((~~1. Any building where more than 50 percent of the roof area is shaded from direct beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.~~

~~2. Any building where more than 80 percent of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, planters, vegetated space, skylights or occupied roof deck.~~

~~3. Buildings which can document they do not have adequate roof area to install the required on-site solar and that comply with Section C411.1.1 may install a lesser amount of on-site renewables but not zero.~~))

1. Where a building's net roof area is not large enough to accommodate the entire on-site renewable energy generation system required by this section, the portion of that system that cannot be accommodated within the net roof area is permitted to be provided by one of the following options:
   a. Additional efficiency credits in accordance with Section C411.1.1.
   b. Off-site renewable energy in accordance with Section C411.2.1, including the requirements of Sections C411.2 and C411.2.2.

   For the purposes of this exception, the net roof area excludes the following:
   a. Areas shaded by existing natural or built objects in accordance with Exception 1 of Section C411.3.
   b. Areas occupied by mechanical equipment, including adjacent equipment service areas required by manufacturer or by applicable code.
   c. Areas required by applicable codes to remain clear for egress, fire department access, or equipment access.
   d. Areas with slopes greater than 2:12.
   e. Planted or vegetated areas.
   f. Skylights.
   g. Occupied roof decks.
2. Reduced Building Performance Factor. For projects utilizing the Section C407 Total Building Performance compliance path the on-site renewable energy generation system is not required where the building performance factor (BPF) is not less than 3 percent lower than the maximum BPF permitted cumulatively by all other sections of this code.

Example: To use this exception, a building with a required BPF of 50 would be required to provide a BPF of (50 x 0.97 =) 48.5 instead.

   2.1. Where the BPF is not less than 1 percent lower than the BPF required cumulatively by other sections of this code, the size of the on-site renewable energy generation system is permitted to be reduced by 1/3.
   2.2. Where the BPF is not less than 2 percent lower than the BPF required cumulatively by other sections of this code, the size of the on-site renewable energy generation system is permitted to be reduced by 2/3.
3. Transfer to an *affordable housing* project. Where *approved* by SDCI, all or part of the required on-site renewable energy generation system is permitted to be replaced by construction of a system that is 50 percent of the required system size when located on an existing *affordable housing* project within the City of Seattle, or 75 percent of the required system size when located on a new construction *affordable housing* project within the City of Seattle. Documentation demonstrating that the renewable energy generation system has been installed on the *affordable housing* project site, the system is fully operational, and ownership has been transferred to the owner of the *affordable housing* project, must be submitted prior to issuance of the certificate of occupancy.

SDCI Informative Note: Option 3 will only be available if an *affordable housing* project is available to accept the renewable energy system. There is no assurance that such a project location will be available. It is the owner's responsibility to locate and coordinate with the *affordable housing* project, and to ensure that the installation is completed in a timely manner.

4. Transfer to a Washington State agency program. Where *approved* by SDCI, all or part of the required renewable energy generation system is permitted to be replaced by a contribution of $2.50 for each required watt of installed capacity, to a solar energy fund managed by a Washington State agency that will provide solar energy installations

for *affordable housing* projects. Documentation demonstrating that the contribution has been received by the state agency must be submitted prior to issuance of the certificate of occupancy.

SDCI Informative Note: Option 4 is available via the solar energy fund for *affordable housing* of the Washington State Housing Finance Commission. Contact: energy@wshfc.org.

5. *Affordable housing*. The on-site renewable energy generation system is not required for *affordable housing* projects.

SDCI Informative Note: Fire Department requirements for solar arrays are located in Section 1204 of the Seattle Fire Code.

C411.1.1 Additional efficiency credits. Buildings which qualify for ((~~one of the exceptions~~)) Exception 1 in Section C411.1 to omit installation of on-site renewable energy ((~~must~~)) are permitted to achieve ((~~an~~)) additional ((~~18~~)) efficiency package credits from Table C406.2(1) equal to five times the number of credits provided for compliance with the renewable energy measure detailed in Section C406.2.5, in lieu of installing the on-site renewable energy required by Section C411.1. The additional ((~~18~~)) credits ((~~can~~)) are permitted to be reduced based on a prorated fraction of renewable capacity that is installed on-site.

On-site renewable energy installations of lower than required capacity can be counted proportionally toward achievement of required or additional efficiency credits in Section C411.1.1 based on the capacity of renewable energy installed compared to the requirements of Section C411.1.

C411.2 On-site and off-site renewable energy accounting. Qualifying on-site and off-site renewable energy delivered or credited to the building project to comply with this code shall meet the requirements of this section. Renewable energy certificates for an on-site or off-site renewable energy system shall be retired on behalf of the building owner for a period of not less than 15 years and tracked in accordance with Section C411.2.3 and submitted to the code official ((~~as part of the permit application~~)) before the final inspection. Renewable energy certificates (RECs) themselves are not a qualifying type of off-site renewable energy system.

C411.2.1 Qualifying types of off-site renewable energy systems. The following are considered qualifying off-site renewable energy systems:

1. Self-generation (an off-site renewable energy system owned by the building project owner) systems complying with Section C411.2.2.
2. Community renewable energy facility systems complying with Section C411.2.2.
3. ((~~Purchase~~)) Renewable power purchase agreement (PPA) contracts complying with Section C411.2.2 and, where applicable, Section C411.2.3.
4. Each source of renewable energy delivered to or credited to the building project shall be connected to the Western Interconnection and energy or capacity multiplied by the factors in Table C411.2.1.

Table C411.2.1
Multipliers for Renewable Energy Procurement Methods

Location	Renewable Energy Source	Renewable Energy Factor		
		In the state of Washington	Western Interconnected	In the states of Oregon or Idaho
On-site	On-site renewable energy system	1	NA	NA
Off-site	Directly owned off-site renewable energy system that begins operation after submission of the initial permit application	0.95	0.75	0.85
Off-site	Community renewable energy facility that begins operation after submission of the initial permit application	0.95	0.75	0.85
Off-site	Directly owned off-site renewable energy system that begins operation before submission of the initial permit application	0.75	0.55	0.65
Off-site	Community renewable energy facility that begins operation before submission of the initial permit application	0.75	0.55	0.65
Off-site	Renewable Power Purchase Agreement (PPA)	0.75	0.55	0.65
Off-site	*Renewable Energy Investment Fund* (REIF)	0.95	0.75	0.85

C411.2.2 Documentation requirements for off-site renewable energy systems. Off-site renewable energy delivered or credited to the building project to comply with Section C407.3 item 2.2, or other requirements of this code, shall be subject to a legally binding contract to procure qualifying off-site renewable energy. Qualifying off-site renewable energy shall meet the following requirements:

1. Documentation of off-site renewable energy procurement shall be submitted to the *code official* before the final inspection.
2. The purchase contract shall have a duration of not less than 15 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property.
3. Records on renewable power purchased by the building owner from the off-site renewable energy generator that specifically assign the RECs to the building owner shall be retained or retired by the building owner on behalf of the entity demonstrating financial or operational control over the building seeking compliance to this standard and made available for inspection by the *code official* upon request.
4. Where multiple buildings in a building project are allocated energy procured by a contract subject to this section, the owner shall allocate for not less than 15 years the energy procured by the contract to the buildings in the building project. A plan on operation shall be developed which shall indicate how renewable energy produced from on-site or off-site systems that is not allocated before issuance of the certificate of occupancy will be allocated to new or existing buildings included in the building project.

C411.2.3 Renewable energy certificate (REC) tracking. For multitenant buildings where RECs are transferred to tenants, the plan for operation shall include procedures for tracking the quantity and vintage of RECs that are required to be retained and retired. The plan shall include provisions to transfer the RECs to building tenants, or to retire RECs on their behalf, in proportion to the gross conditioned and semi-heated floor area leased or rented. The plan shall include provisions to use a REC tracking system that meets the requirements of Section V.B of the Green-e Framework for Renewable Energy Certification. The plan shall describe how the building owner will procure alternative qualifying renewable energy in the case that the renewable energy producer ceases. The plan shall be submitted to the *code official* prior to the final inspection.

C411.3 Solar readiness. A solar zone shall be provided on buildings that are 20 stories or less in height above grade plan. The solar zone shall be located on the roof of the building or on another structure elsewhere on the site. The solar zone shall be in accordance with this section and the *International Fire Code*.

EXCEPTION: A solar zone is not required under the following conditions:

1. Where the solar exposure of the building's roof area is less than 75 percent of that of an unshaded area, as defined in Section ((~~C411.5~~)) C411.3.4, in the same location, as measured by one of the following:
   1.1. Incident solar radiation expressed in kWh/ft^2-yr using typical meteorological year (TMY) data.
   1.2. Annual sunlight exposure expressed in cumulative hours per year using TMY data.
   1.3. Shadow studies indicating that the roof area is more than 25 percent in shadow, on September 21st at 10 a.m., 11 a.m., 12 p.m., 1 p.m., and 2 p.m. solar time.
2. Buildings, building additions, changes in space conditioning or occupancy where the total floor area is equal to or less than 500 square feet.

SDCI Informative Note: Requirements for solar arrays are located in Section 1204 of the Seattle Fire Code.

C411.3.1 Minimum area. The minimum area of the solar zone shall be determined by one of the following methods, whichever results in the smaller area:

1. 40 percent of roof area. The roof area shall be calculated as the horizontally projected gross roof area less the area covered by skylights, occupied roof decks, mechanical equipment, mechanical equipment service clearances required by equipment manufacturer or by code, and planted areas.
2. 20 percent of electrical service size. The electrical service size is the rated capacity of the total of all electrical services to the building, and the required solar zone size shall be based upon 10 peak watts of photovoltaic per square foot.

EXCEPTION: Subject to the approval of the code official, buildings with extensive rooftop equipment that would make full compliance with this section impractical shall be permitted to reduce the size of the solar zone required by Section C411.3 to the maximum practicable area.

Example: A building with a 10,000 SF total roof area, 1,000 SF skylight area, and a 400 Amp, 240 volt single phase electrical service is required to provide a solar zone area of the smaller of the following:

1. [40% × (10,000 SF roof area - 1,000 SF skylights)] = 3,600 SF; or
2. [400 Amp × 240 Volts × 20% / 10 watts per SF] = 1,920 SF

Therefore, a *solar zone* of 1,920 square feet is required.

C411.3.2 Contiguous area. The solar zone is permitted to be comprised of separated subzones. Each subzone shall be at least 5 feet wide in the narrowest dimension.

C411.3.3 Obstructions. The solar zone shall be free of pipes, vents, ducts, HVAC equipment, skylights and other obstructions, except those serving photovoltaic systems within the solar zone. The solar zone is permitted to be located above any such obstructions, provided that the racking for support of the future system is installed at the time of construction, the elevated solar zone does not shade other portions of the solar zone, and its height is permitted by the *International Building Code* and the Seattle Land Use Code. Photovoltaic or solar water heating systems are permitted to be installed within the solar zone.

C411.3.4 Shading. The solar zone shall be set back from any existing or new object on the building or site that is located south, east or west of the solar zone a distance at least two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees, and roof plantings. No portion of the solar zone shall be located on a roof slope greater than 2:12 that faces within 45 degrees of true north.

C411.3.5 Access. Areas contiguous to the solar zone shall provide access pathways and provisions for emergency smoke ventilation as required by the *International Fire Code*.

C411.3.6 Structural integrity. The as-designed dead load and live load for the solar zone shall be clearly marked on the record drawings and shall accommodate future photovoltaic system arrays at an assumed dead load of 4 pounds per square foot in addition to other required live and dead loads. A location for future inverters shall be designated either within or adjacent to the solar zone, with a minimum area of 2 square feet for each 1000 square feet of solar zone area, and shall accommodate an assume dead load of 175 pounds per square foot. Where photovoltaic systems are installed in the solar zone, structural analysis shall be based upon calculated loads, not upon these assumed loads.

C411.3.7 Photovoltaic interconnection. A minimum 2-inch diameter roof penetration conduit shall be provided, with threaded caps above and below the roof deck and minimum R-10 insulation wrapping the lower portion, within each 2,500 square foot section of the required *solar zone* area. Interconnection of the future photovoltaic system shall be provided for at the main service panel, either ahead of the service disconnecting means or at the end of the bus opposite the service disconnecting means, in one of the following forms:

1. A space for the mounting of a future overcurrent device, sized to accommodate the largest standard rated overcurrent device that is less than 20 percent of the bus rating.
2. Lugs sized to accommodate conductors with an ampacity of at least 20 percent of the bus rating, to enable the mounting of an external overcurrent device for interconnection.

The electrical construction documents shall indicate all of the following:

1. Solar zone boundaries and access pathways.
2. Location for future inverters and metering equipment.
3. Route for future wiring between the photovoltaic panels and the inverter, and between the inverter and the main service panel.

SECTION C412
COMPRESSED AIR SYSTEMS

C412.1 General. All new *compressed air systems*, and all additions or alterations of *compressed air systems* where the total combined horsepower (hp) of the compressor(s) is 25 hp or more, shall meet the requirements of this section. These requirements apply to the compressors, related piping systems, and related controls that provide compressed air and do not apply to any equipment or controls that use or process the compressed air.

EXCEPTION: Medical gas compressed air systems in health care facilities.

C412.2 Trim compressor and storage. The compressed air system shall be equipped with an appropriately sized trim compressor and primary storage to provide acceptable performance across the range of the system and to avoid control gaps. The compressed air system shall comply with 1 or 2 below:

1. The *compressed air system* shall include one or more variable speed drive (VSD) compressors. For systems with more than one compressor, the total combined capacity of the VSD compressor(s) acting as trim compressors must be at least 1.25 times the *largest net capacity increment* between combinations of compressors. The *compressed air system* shall include *primary storage* of at least one gallon per actual cubic feet per minute (acfm) of the largest trim compressor; or
2. The *compressed air system* shall include a compressor or set of compressors with total effective trim capacity at least the size of the *largest net capacity increment* between combinations of compressors, or the size of the smallest compressor, whichever is larger. The total effective trim capacity of single compressor systems shall cover at least the range from 70 percent to 100 percent of rated capacity. The effective trim capacity of a compressor is the size of the continuous operational range where the specific power of the compressor (kW/100 acfm) is within 15 percent of the

Chapter 5 [CE]
EXISTING BUILDINGS

SECTION C501
GENERAL

C501.1 Scope. The provisions of this chapter shall control the *alteration, repair*, *addition* and change of occupancy of existing buildings and structures.

C501.1.1 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code. Unaltered portions of existing buildings used for residential purposes that received a certificate of occupancy at least three years prior to a permit application for residential uses shall not be required to comply with this code, except where required by other provisions of this code.

C501.2 Compliance. *Additions*, *alterations*, *repairs*, changes in space conditioning and changes of occupancy to, or relocation of, existing buildings and structures shall comply with Section C502, C503, C504, or C505 of this code, and with all applicable provisions in the *International Building Code*, *International Existing Building Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *Uniform Plumbing Code*, and ((~~NFPA 70~~)) the Seattle Electrical Code.

C501.2.1 *U*-factor requirements for additions and alterations. For existing building projects where an *addition* or *building envelope alteration area* is combined with existing-to-remain building areas to demonstrate compliance with this code as a whole building, the *U*-factors applied to existing-to-remain envelope assemblies shall be in accordance with record documents.

EXCEPTION: If accurate record documents are not available, *U*-factors for the existing envelope assemblies may be in accordance with the edition of the ((~~Washington State~~)) Seattle Energy Code that was in effect at the time the building was permitted, or as approved by the *code official*.

C501.2.2 Calculations of mechanical heating and cooling loads for alterations. For the installation of new or replacement mechanical equipment that serves existing building areas, design loads associated with heating, cooling and ventilation of the existing building areas served shall be determined in accordance with Section C403.1.2.

R-values and *U*-factors used to determine existing thermal envelope performance for the purpose of calculating design loads shall be in accordance with record documents or existing conditions.

EXCEPTION: If accurate record documents are not available, *R*-values and *U*-factors used to determine existing building thermal envelope performance may be in accordance with the edition of the ((~~Washington State~~)) Seattle Energy Code that was in effect at the time the building was permitted, or as *approved* by the *code official*.

C501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

C501.4 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

C501.5 ((~~Historic buildings~~)) Landmarks. The *code official* may modify the specific requirements of this code for *landmarks* and require in lieu thereof alternate provisions that the *code official* determines will not have an adverse effect on the designated historic features of the building and will result in a reasonable degree of energy efficiency.

((~~Provisions of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall not be mandatory for historic buildings provided that a report has been submitted to the code official and signed by a registered design professional, or a representative of the state historic preservation office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade or destroy the historic form, fabric or function of the building.~~))

C501.6 Commissioning. Existing building systems shall be commissioned in accordance with Section C408. For the purposes of meeting the commissioning thresholds in Section C408.1, only the new and altered system capacities are considered when determining whether the project is exempt from some portion of the commissioning process.

SECTION C502
ADDITIONS

C502.1 General. *Additions* to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. *Additions* shall not create an unsafe or hazardous condition or overload existing building systems. An *addition* shall be deemed to comply with this code if the *addition* alone complies or if the existing building and *addition* comply with this code as a single building.

This allowance applies to prescriptive compliance in accordance with Section C502.2 or total building performance in accordance with Section C407.

C502.1.1 Additional energy efficiency credits. Additions shall comply with Section C406.1. The addition shall be deemed to comply with this section if the addition alone complies or if the addition area is combined with existing building areas to demonstrate compliance with an additional efficiency credit.

Exception: *Additions* smaller than 500 square feet of *conditioned floor area* are not required to comply with Section C406.

C502.1.2 Renewable energy. Additions shall comply with Section C411. The addition shall be deemed to comply with this section if the addition alone complies or if the addition area is combined with existing building areas to demonstrate compliance with the requirements for on-site renewable energy or solar readiness, as applicable.

C502.2 Prescriptive compliance. *Additions* shall comply with Sections ((~~C502.3 through C502.8~~)) C502.2.1 through C502.2.8.

C502.2.1 Vertical fenestration. *Additions* with *vertical fenestration* that results in a total building vertical fenestration area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.4. *Additions* with *vertical fenestration* that results in a total building *vertical fenestration area* greater than that specified in Section C402.4.1 shall comply with one of the following:

1. Component performance alternative with target area adjustment per Section C402.1.5 for the *addition* area of the building only.
2. Existing building and *addition* area are combined to demonstrate compliance with the component performance alternative for the whole building.
3. Total building performance in accordance with Section C407 for the *addition* area of the building only.
4. Total building performance for the whole building.

C502.2.2 Skylights. *Additions* with *skylights* shall comply with the following:

1. Where an *addition* with skylight area results in a total building skylight area less than or equal to the maximum allowed by Section C402.4.1, the *addition* shall comply with Section C402.4.
2. Where an *addition* with skylight area results in a total building skylight area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the *addition*), the *addition* shall comply with one of the following:
   2.1. Component performance alternative with target area adjustment per Section C402.1.5 for the addition area of the building only.
   2.2. Existing building and addition area are combined to demonstrate compliance with the component performance alternative for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1.
   2.3. Total building performance in accordance with Section C407 for the addition area of the building only.
   2.4. Total building performance for the whole building.

C502.2.3 (Reserved)

C502.2.4 Building mechanical systems. New mechanical systems and equipment serving the building heating, cooling or ventilation needs, that are installed as a part of the *addition* shall comply with Sections C403, C408.2, ((~~C409.5~~)) C506.1, and C501.6.

C502.2.5 Service water heating systems. New service water-heating systems and equipment that are installed as a part of the *addition* shall comply with Sections C404, C408.3, ((~~C409.5~~)) C506.1, and C501.6.

C502.2.6 Pools and permanent spas. Systems and equipment serving new pools and permanent spas that are installed as a part of the *addition* shall comply with Sections C404.11, C408.3, ((~~C409.5~~)) C506.1, and C501.6.

C502.2.7 Electrical power and lighting systems and motors. New electrical power and lighting systems and motors that are installed as a part of the *addition* shall comply with Sections C405, C408.4, ((~~C409.5~~)) C506.1, and C501.6.

C502.2.7.1 Interior lighting power. The total interior lighting power for the addition shall comply with Section C405.4.2 for the addition alone, or the existing building and the addition shall comply as a single building.

C502.2.7.2 Exterior lighting power. The total exterior lighting power for the addition shall comply with Section C405.5.2 for the addition alone, or the existing building and the addition shall comply as a single building.

C502.2.8 Refrigeration systems. New refrigerated spaces and refrigeration systems and equipment that are installed as a part of the *addition* shall comply with Sections C408.7, ((~~C409.5~~)) C506.1, C410, and C501.6.

C502.3 Building envelope. Additions shall comply with Sections C402.1 through C402.5, C502.3.1, and C502.3.2.

EXCEPTION: Air leakage testing is not required for additions smaller than 500 square feet.

C502.3.1 Vertical fenestration. Additions with *vertical fenestration* shall comply with the following:

1. Where an *addition* with *vertical fenestration* area results in a total building *vertical fenestration* area less than or equal to the maximum allowed by Section C402.4.1, the addition shall comply with Section C402.4.
2. Where an *addition* with *vertical fenestration* area results in a total building vertical fenestration area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the *addition*), the *addition* shall comply with one of the following:
   2.1. Component performance alternative with target area adjustment per Section C402.1.5 for the addition area of the building only.
   2.2. Existing building and addition area are combined to demonstrate compliance with the component performance alternative for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1.
   2.3. Total building performance in accordance with Section C407 for the addition area of the building only.
   2.4. Total building performance for the whole building.

SECTION C503
ALTERATIONS

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the alteration. The additional energy efficiency credit requirements in Section C406.1 and the renewable energy requirements in Section C411 do not apply to alterations, except substantial alterations or change of space conditioning, occupancy, or use, in compliance with Section C505. Substantial alterations and *repair*s shall comply with Section C503.9.

EXCEPTION: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Surface applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are insulated to full depth with insulation having a minimum nominal value of R-3.0 per inch installed per Section C402.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. *Roof recover*.
6. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
7. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided however that an existing vestibule that separates a conditioned space from the exterior shall not be removed.

C503.2 Reserved.

C503.3 Building envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5 and Sections C503.3.1 through C503.3.3. Where an opaque envelope assembly is altered or replaced, the new assembly shall in no case have a higher overall U-value than the existing.

EXCEPTION: Air leakage testing is not required for alterations and repairs, unless the project has been defined as a substantial alteration according to Section C503.9, or includes a change in space conditioning according to Section ((~~C503.2~~)) C505.2 or a change of occupancy or use according to Section ((~~C505.1~~)) C505.3.

C503.3.1 Roof replacement. *Roof replacements* shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the *building thermal envelope* and contains no insulation or the insulation is located entirely above the roof deck. In no case shall the *R*-value of the roof insulation be reduced or the *U*-factor of the roof assembly be increased as part of the *roof replacement*.

C503.3.2 Vertical fenestration. Alterations that include the addition of new vertical fenestration area shall comply with the following:

1. Where the addition of new *vertical fenestration* ((~~that~~)) area results in a total building vertical fenestration area less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the addition of new *vertical fenestration* area ((~~result~~)) results in a total building *vertical fenestration* area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the addition), the alteration shall comply with one of the following:
    2.1. Vertical fenestration alternate in accordance with Section ((~~C402.1.3~~)) C402.4.1.1 for the new vertical fenestration added, where the calculation of vertical fenestration area and gross *above-grade wall* area shall include either the entire building or, where *approved*, only those areas of the building involved in the *alteration*.
    2.2. ((~~Vertical fenestration alternate in accordance with Section C402.4.1.1 for the area adjacent to the new vertical fenestration added.~~)) (Reserved)
    2.3. Existing building and alteration areas are combined to demonstrate compliance with the component performance alternate in accordance with Section C402.1.5 for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1. The Proposed Total UA is allowed to be up to 110 percent of the Allowed Total UA.
    2.4. Total building performance in accordance with Section C407 for the whole building. The total annual ((~~carbon emissions from~~)) energy consumption of the proposed design is allowed to be up to 110 percent of the annual ((~~carbon emissions from~~)) energy consumption allowed in accordance with Section C407.3.
    2.5. The alteration does not increase the existing fenestration area.

EXCEPTION: Where *approved* by the *code official*, additional *fenestration* is permitted where sufficient envelope upgrades beyond those required by other sections of this code are included in the project so that the addition of new *vertical fenestration* does not cause an increase in the overall energy use of the building.

C503.3.2.1 Replacement fenestration products. Where some or all of an existing *fenestration* unit is replaced with a new *fenestration* product, including sash and glazing, the replacement *fenestration* unit shall meet the applicable requirements for *U*-factor and *SHGC* in Table C402.4. In addition, the area-weighted U-value of the new fenestration shall be equal to or lower than the U-value of the existing fenestration.

EXCEPTION: An area-weighted average of the *U*-factor of replacement fenestration products being installed in the building for each fenestration product category listed in Table C402.4 shall be permitted to satisfy the *U*-factor requirements for each fenestration product category listed in Table C402.4. Individual fenestration products from different product categories listed in Table C402.4 shall not be combined in calculating the area-weighted average *U*-factor.

C503.3.3 Skylights. Alterations that include the addition of new skylight area shall comply with the following:

1. Where the addition of new *skylight* area results in a total building skylight area less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the addition of new *skylight* area results in a total building skylight area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the addition), the alteration shall comply with one of the following:
    2.1. Existing building and alteration area are combined to demonstrate compliance with the component performance alternative with target area adjustment in accordance with Section C402.1.5 for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1. The Proposed Total UA is allowed to be up to 110 percent of the Allowed Total UA.
    2.2. Total building performance in accordance with Section C407 for the whole building. The annual ((~~carbon emissions from~~)) energy consumption of the proposed design is allowed to be up to 110 percent of the annual ((~~carbon emissions from~~)) energy consumption allowed in accordance with Section C407.3.

EXCEPTION: Additional envelope upgrades are included in the project so the addition of new skylights does not cause a reduction in overall building energy efficiency, as *approved* by the *code official*.

C503.4 Building mechanical systems. Components of existing mechanical systems that are altered or replaced shall comply with Section C403 or Section C407, unless specifically exempted in Section C503.4, and Sections C408.2, ((~~C409.5~~)) C506.1, C501.2.2, C501.6, and C503.4.2 through C503.4.6. Additions or alterations shall not be made to an existing mechanical system that will cause the existing system to become out of compliance.

EXCEPTIONS:

1. Existing mechanical systems are not required to be modified to comply with Section C403.3.5 where mechanical cooling capacity is not added to a system that did not have cooling capacity prior to the alteration.
2. Compliance with Section C403.1.4 is not required where the alteration does not include replacement of a heating appliance.
3. Alternate mechanical system designs that are not in full compliance with this code may be approved when the code official determines that existing building constraints including, but not limited to, available mechanical space, limitations of the existing structure, or proximity to adjacent air intakes or exhausts makes full compliance impractical. Alternate designs shall include additional energy saving strategies not prescriptively required by this code for the scope of the project including, but not limited to, demand control ventilation, energy recovery, or increased mechanical cooling or heating equipment efficiency above that required by Tables C403.3.2(1) through C403.3.2 (16).
4. Only those components of existing HVAC systems that are altered or replaced shall be required to comply with Section C403.8.1. Section C403.8.1 does not require the removal and replacement of existing system ductwork. Additional fan power allowances are available when determining the fan power budget (Fan kW_{budget}) as specified in Table C503.4. These values can be added to the fan power allowance values in Tables C403.8.1.1(1) and C403.8.1.1(2) when calculating a new Fan kW_{budget} for the fan system being altered. The additional fan power allowance is not applicable to alterations that add or change passive components which do not increase the fan system static pressure.

Table C503.4
Additional Fan Power Allowances (W/CFM)

Airflow	Multi-Zone VAV Systems[a] ≤5,000 cfm	Multi-Zone VAV Systems[a] >5,000 and ≤10,000 cfm	Multi-Zone VAV Systems[a] >10,000 cfm	All Other Fan Systems ≤5,000 cfm	All Other Fan Systems >5,000 and ≤10,000 cfm	All Other Fan Systems >10,000 cfm
Supply *Fan System* additional allowance	0.135	0.114	0.105	0.139	0.120	0.107
Supply *Fan System* additional allowance in unit with adapter curb	0.033	0.033	0.043	0.000	0.000	0.000
Exhaust/Relief/Return/Transfer Fan System additional allowance	0.070	0.061	0.054	0.070	0.062	0.055
Exhaust/Relief/Return/Transfer *Fan System* additional allowance with adapter curb	0.016	0.017	0.220	0.000	0.000	0.000

a See definition of *FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV)*.

C503.4.1 New building mechanical systems. All new mechanical systems and equipment in existing buildings shall comply with Sections C403, C408.2, ((~~C409.5~~)) C506.1, and C501.6.

C503.4.2 Addition of cooling capacity. Where mechanical cooling is added to a space that was not previously cooled, the mechanical system shall comply with either Section C403.3.5 or C403.5.

EXCEPTIONS:

1. Qualifying small equipment: Economizers are not required for cooling units and split systems serving one zone with a total cooling capacity rated in accordance with Section C403.3.2 of less than 33,000 Btu/h (hereafter referred to as qualifying small systems) provided that these are high-efficiency cooling equipment with SEER and EER values more than 15 percent higher than minimum efficiencies listed in Tables C403.3.2 (1), (2), (4), (8), (9), and (14), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all qualifying small equipment without economizers shall not exceed 72,000 Btu/h per building, or 5 percent of the building total air economizer capacity, whichever is greater.

   Notes and exclusions for Exception 1:

   1.1. The portion of the equipment serving Group R occupancies is not included in determining the total capacity of all units without economizers in a building.

   1.2. Redundant units are not counted in the capacity limitations.

1.3. This exception shall not be used for the initial tenant improvement of a shell-and-core building or space, or for Total Building Performance in accordance with Section C407.

1.4. This exception shall not be used for unitary cooling equipment installed outdoors or in a mechanical room adjacent to the outdoors.

2. Chilled water terminal units connected to systems with chilled water generation equipment with IPLV values more than 25 percent higher than minimum part load equipment efficiencies listed in Table C403.3.2 (3), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all systems without economizers shall not exceed ((~~480,000~~)) 72,000 Btu/h (141 kW) per building, or 20 percent of the building total air economizer capacity, whichever is greater.

Notes and exclusions for Exception 2:

2.1. The portion of the equipment serving Group R occupancy is not included in determining the total capacity of all units without economizers in a building.

2.2. This exception shall not be used for the initial tenant improvement of a shell-and-core building or space, or for total building performance in accordance with Section C407.

C503.4.3 Alterations or replacement of existing cooling systems. Alterations to, or replacement of, existing mechanical cooling systems shall not decrease the building total economizer capacity unless the system complies with either Section C403.3.5 or C403.5. System alterations or replacement shall comply with Table C503.4.3 when either the individual cooling unit capacity or the building total capacity of all cooling equipment without economizer does not comply with the exceptions in Section C403.5. Equipment replacements that include space heating shall also comply with Section C503.4.6.

C503.4.3.1 Addition of new or replacement of existing air-cooled chiller systems. Where one or more air-cooled chillers are added or replaced, and the existing HVAC heating equipment is included in one of the categories listed below and is fossil fuel–fired or electric resistance, the replacement cooling appliance shall be an electric heat pump system in compliance with Section C403.1.4, integrated with the existing HVAC heating system and configured to serve as the first stage of heating when conditions permit use of the fluid temperatures produced by the heat pump system, with the existing fossil fuel–fired or electric resistance HVAC heating equipment serving as supplemental heat. Additions, alterations, or replacements shall not be made to an existing HVAC heating system that will cause the system to become out of compliance.

Exceptions:

1. Exempt buildings and occupancies. The new heat pump is not required to serve as the first stage of heating if it serves any of the following building categories and the requirements of Section C503.4.6.2 are met.
    a. Affordable housing.
    b. Group I-1, I-2, and I-3 occupancies.
    c. Buildings with more than 50 percent of conditioned floor area occupied by organizations recognized as nonprofit by the State of Washington or by federal tax law.
    d. Buildings with no more than 20,000 square feet of conditioned floor area.
2. Exempt systems. Air-cooled chillers that serve dedicated server rooms, electronic equipment rooms, telecom switch rooms, or similar spaces that only require cooling and do not have any associated space heating equipment are not required to be replaced with heat pump systems. New heat pump systems are not required to serve as the first stage of heating if they serve any of the following system types, and if the requirements of Section C503.4.6.2 are met.
    a. Steam heating systems, including replacement of existing steam boilers with steam distribution piping to terminal units and replacement of the existing associated boiler feed equipment.
    b. Terminal unit equipment including but not limited to electric resistance VAV boxes, electric duct heaters, electric resistance fan coils, or electric resistance heaters.

Table C503.4.3
Economizer Compliance Options for Mechanical Alterations

Unit Type	Option A Any alteration with new or replacement equipment	Option B (alternate to A) Replacement unit of the same type with the same or smaller output capacity	Option C (alternate to A) Replacement unit of the same type with a larger output capacity	Option D (alternate to A) New equipment added to existing system or replacement unit of a different type
1. Packaged Units	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: min. [a] Economizer: C403.5[b]
2. Split Systems	Efficiency: min. [a] Economizer: C403.5[b]	For units ≤ 60,000 Btuh, comply with two of two measures: 1. Efficiency: + 10%[e] 2. Economizer: shall not decrease existing economizer capability	For units ≤ 60,000 Btuh replacing unit installed prior to 1991 comply with at least one of two measures: 1. Efficiency: + 10%[e] 2. Economizer: 50% [f]	Efficiency: min. [a] Economizer: C403.5[b]
		For all other capacities: Efficiency: min.[a] Economizer: C403.5[b]	For all other capacities: Efficiency: min.[a] Economizer: C403.5[b]	
3. Water Source Heat Pump	Efficiency: min. [a] Economizer: C403.5[b]	For units ≤ 72,000 Btuh, comply with at least two of three measures: 1. Efficiency: +10%[e] 2. Flow control valve [g] 3. Economizer: 50% [f]	For units ≤ 72,000 Btuh, comply with at least three of three measures: 1. Efficiency: +10%[e] 2. Flow control valve [g] 3. Economizer: 50% [f] (except for certain pre-1991 systems [q])	Efficiency: min. [a] Economizer: C403.5[b] (except for certain pre-1991 systems [q])
		For all other capacities: Efficiency: min.[a] Economizer: C403.5[b]	For all other capacities: Efficiency: min.[a] Economizer: C403.5[b]	
4. Water Economizer using Air-Cooled Heat Rejection Equipment (Dry Cooler)	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: + 5%[d] Economizer: shall not decrease existing economizer capacity	Efficiency: min.[a] Economizer: C403.5[b]	Efficiency: min. [a] Economizer: C403.5[b]
5. Air-Handling Unit (including fan coil units) where the system has an air-cooled chiller	Efficiency: min. [a] Economizer: C403.5[b]	Economizer: shall not decrease existing economizer capacity	Efficiency: min.[a] Economizer: C403.5[b] (except for certain pre-1991 systems [q])	Efficiency: min.[a] Economizer: C403.5[b] (except for certain pre-1991 systems [q])
6. Air-Handling Unit (including fan coil units) and Water-cooled Process Equipment, where the system has a water-cooled chiller[10]	Efficiency: min. [a] Economizer: C403.5[b]	Economizer: shall not decrease existing economizer capacity	Efficiency: min.[a] Economizer: C403.5[b] (except for certain pre-1991 systems [q] and certain 1991-2016 systems [i])	Efficiency: min. [a] Economizer: C403.5[b] (except for certain pre-1991 systems [q] and certain 1991-2016 systems [i])
7. Cooling Tower	Efficiency: min. [a] Economizer: C403.5[b]	No requirements	Efficiency: min.[a] Economizer: C403.5[b]	Efficiency: min.[a] Economizer: C403.5[b]

Table C503.4.3—continued
Economizer Compliance Options for Mechanical Alterations

Unit Type	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
	Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity	New equipment added to existing system or replacement unit of a different type
8. Air-Cooled Chiller	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: + 10%[k] Economizer: shall not decrease existing econo-mizer capacity	Efficiency: Comply with two of two measures: 1. + 10% [k,l] and 2. Multistage compressor(s) Economizer: shall not decrease existing econo-mizer capacity	Efficiency: min. [a] Economizer: C403.5[b]
9. Water-Cooled Chiller	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: Comply with at least one of two measures: 1. Part load IPLV + 15%[n] or 2. Plate frame heat exchanger [o] Economizer: shall not decrease existing econo-mizer capacity	Efficiency: Comply with two of two measures: 1. Part load IPLV + 15% [n] 2. Plate-frame heat exchanger [o] Economizer: shall not decrease existing econo-mizer capacity	Efficiency: min. [a] Economizer: C403.5[b]
10. Package Terminal Air Conditioner	Efficiency: min. [a] Economizer: C403.5[b]	Efficiency: + 5%[a] Economizer: shall not decrease existing econo-mizer capacity	Efficiency: + 5%[a] Economizer: shall not decrease existing econo-mizer capacity	Efficiency: min. [a] Economizer: C403.5[b]
11. Package Terminal Heat Pump	Efficiency: min. [a] Economizer: C403.5[b]	Cooling efficiency: + 5%[d] Heating efficiency: + 10%[e] Shall not decrease existing economizer capacity	Cooling efficiency: + 5%[d] Heating efficiency: + 10%[e] Shall not decrease existing economizer capacity	Efficiency: min. [a] Economizer: C403.5[b]

a Minimum equipment efficiency shall comply with Section C403.3.2 and the tables in Section C403.3.2.

b All separate new equipment and replacement equipment shall have air economizer complying with Section C403.5 including both the individual unit size limits and the total building capacity limits on units without economizer. It is acceptable to comply using one of the exceptions to Section C403.5.

c Reserved.

d Equipment shall have a capacity-weighted average cooling system efficiency that is 5% better than the requirements in the tables in Section C403.3.2 (1.05 × values in the tables.

e Equipment shall have a capacity-weighted average cooling system efficiency that is 10% better than the requirements in the tables in Section C403.3.2 (1.10 × values in the tables.

f Minimum of 50% air economizer that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that they are physically fastened so that the outside air duct is directed into the unit intake. If this is an increase in the amount of outside air supplied to this unit, the outside air supply system shall be configured to provide this additional outside air and be equipped with economizer control.

g Water-source heat pump systems shall have a flow control valve to eliminate flow through the heat pumps that are not in operation and variable speed pumping control complying with Section C403.4.3 for that heat pump.

- When the total capacity of all units with flow control valves exceeds 15% of the total system capacity, a variable frequency drive shall be installed on the main loop pump.
- As an alternate to this requirement, the capacity-weighted average cooling system efficiency shall be 5% better than the requirements in footnote e for water-source heat pumps (i.e., a minimum of 15% greater than the requirements in Table C403.3.2 (14)).

h Water economizer equipment shall have a capacity-weighted average cooling system efficiency that is 10% better than the requirements in Tables C403.3.2 (7), C403.3.2(10), and C403.3.2 (16) (1.10 × values in Tables C403.3.2 (7), C403.3.2(10), and C403.3.2 (16)).

i Air economizer is not required for systems installed with water economizer plate and frame heat exchanger complying with previous codes between 1991 and June 2016, provided that the total fan coil load does not exceed the existing or added capacity of the heat exchangers.

j For water-cooled process equipment where the manufacturers specifications require colder temperatures than available with waterside economizer, that portion of the load is exempt from the economizer requirements.

k The air-cooled chiller shall have an IPLV efficiency that is a minimum of 10% greater than the IPLV requirements in EER in Table C403.3.2 (3) (1.10 × IPLV values in EER in Table C403.3.2 (3)).

l The air-cooled chiller shall be multistage with a minimum of two compressors.

m ((~~The water-cooled chiller shall have full load and part load IPLV efficiency that is a minimum of 5% greater than the IPLV requirements in Table C403.3.2(3).~~))

n The water-cooled chiller shall have an IPLV value that is a minimum of 15% lower than the IPLV requirements in Table C403.3.2(3) (0.85 × IPLV values in Table C403.3.2(3)). Water-cooled centrifugal chillers designed for nonstandard conditions shall have an NPLV value that is at least 15% lower than the adjusted maximum NPLV rating in kW per ton defined in Section C403.3.2.3 (0.85 × NPLV).

o Economizer cooling shall be provided by adding a plate-frame heat exchanger on the waterside with a capacity that is a minimum of 20% of the chiller capacity at standard AHRI rating conditions.

p Reserved.

q Systems installed prior to 1991 without fully utilized capacity are allowed to comply with Option B, provided that the individual unit cooling capacity does not exceed 90,000 Btuh.

C503.4.4 Controls for cooling equipment replacement. When space cooling equipment is replaced, controls shall comply with all requirements under Section C403.3.5 and related subsections, and Section C403.5.1 for integrated economizer control.

C503.4.5 Mechanical equipment relocation. Existing equipment currently in use may be relocated within the same floor or same tenant space if removed and reinstalled within the same permit.

((~~**C503.4.6 Addition or replacement of heating appliances.** Where a mechanical heating appliance is added or replaced, the added or replaced appliances shall comply with Section C403.1.4 or with an alternate compliance option in Table C503.4.6. Where use of heat pump equipment for space heating is required by this section, it is permissible to utilize the Fossil Fuel Compliance Path in Section C401.3 to attain the credits required for building additions shown in Table C401.3.3.~~

~~**EXCEPTIONS:**~~

1. ~~Terminal unit equipment including, but not limited to, hydronic VAV boxes, electric resistance VAV boxes, electric duct heaters, water source heat pumps, fan coils, or VRF indoor units that are served by an unaltered central system.~~
2. ~~Air handling equipment with hydronic coils~~
3. ~~Air handling equipment designed for 100 percent outdoor air that is not subject to the requirements in Section C403.3.5 or that qualifies for an exception to Section C403.3.5.~~
4. ~~Replacement of existing oil-fired boilers.~~
5. ~~Replacement of existing steam boilers with steam distribution to terminal units and the associated boiler feed equipment.~~
6. ~~Where compliance with Section C403.1.4 would trigger an unplanned utility electrical service upgrade based on the NEC 220.87 method for determining existing loads.~~
7. ~~Replacement of heating equipment with equipment that is the same type and where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.~~))

C503.4.6 Addition or replacement of HVAC heating appliances. New HVAC heating systems shall comply with Section C403.1.4. Where one or more HVAC mechanical heating appliances are added or replaced, the added or replaced appliances shall comply with Section C401.3, Section C403.1.4, Section C407, or with an alternate compliance option in Table C503.4.6, and in all cases with Sections C501.6 and C506.1. When complying with the alternate compliance option in Table C503.4.6, added or replaced HVAC heating appliances must select HVAC heating appliances from one of the Proposed Heating Type Options and the applicable Heating Efficiency Tables. Additions, alterations, or replacements shall not be made to an existing HVAC heating system that will cause the existing system to become out of compliance. Where use of heat pump equipment for space heating is required by this section, it is permissible to utilize the Fossil Fuel Compliance Path in Section C401.3 to attain the credits required for building additions shown in Table C401.3.3.

EXCEPTIONS:

1. Exempt buildings and occupancies. Replacement heating equipment serving any of the following building categories is permitted to use the same fuel type as the existing equipment, provided the replacement equipment complies with the minimum efficiency in Table C503.4.6 and the same or lower capacity than the existing, and that the requirements of Section C503.4.6.2 are met.
   1. *Affordable housing*.
   2. Group I-1, I-2, and I-3 occupancies.
   3. Buildings with more than 50 percent of conditioned floor area occupied by organizations recognized as nonprofit by the State of Washington or by federal tax law.
   4. Buildings with no more than 20,000 square feet of conditioned floor area.
2. Retention of portion of existing system capacity. For buildings not exempted by Exception 1 above, a maximum of 50 percent of the existing fossil fuel or electric resistance heating capacity is permitted to be retained or replaced to serve as supplemental heat for the new heat pump heating system, provided that the supplemental heat is controlled to be used only when the heat pump system capacity is insufficient to meet the load, in compli-

ance with the applicable Exception 5, 6, or 7 to Section C403.1.4, and that the requirements of Section C503.4.6.2 are met. Where an alteration replaces less than 50 percent of the existing fossil fuel or electric resistance heating capacity, the remaining heating appliances are permitted to be retained. Where the alteration project decreases the peak heating load, the fossil fuel or electric resistance heating capacity shall be limited to 50 percent of the calculated peak heating load. The replacement equipment shall comply with the minimum efficiency in Table C503.4.6.

3. Temporary replacement of failing equipment. Temporary like-for-like replacement of one or more heating appliances, in excess of the 50 percent capacity permitted by Exception 2 above, is permitted where those appliances require immediate replacement, and where no other work on the HVAC system is planned. When using this exception, it is acceptable to replace a single appliance with two or more smaller appliances, provided the total capacity is not greater than that of the original appliance. In addition, the requirements of Section C503.4.6.2 shall be met, and the applicant shall ensure completion of the required heat pump system in compliance with one of the following options.
    a. SDCI will issue a temporary certificate of occupancy (TCO), which will remain in force until the heat pump heating system is installed and the final inspection of the system has been completed.
    b. Applicant shall post a performance bond in the amount of the full estimated cost of installation of the required heat pump system, to ensure completion of the heat pump system within 48 months.
4. Utility service upgrade. Compliance with Section C403.1.4 is not required where the requirements of Section C503.4.6.2 are met, and where such compliance would trigger an unplanned utility electrical service upgrade, based on the Seattle Electrical Code Section 220.87 method for determining existing loads, where one or more of the following is required:
    a. A new utility transformer vault located in the existing building or on the site, or an enlargement of the floor area of such a vault.
    b. Trenching across the vehicle lanes of a public way.
    c. The estimated construction cost for the required electrical service enlargement exceeds 50 percent of the project valuation for the remainder of the work, as determined in accordance with the *fee subtitle*. Construction cost shall be documented by an AACE Level 3 or equivalent cost estimate, including required demolition, construction, site work, and utility fees.

    The replacement equipment shall comply with the minimum efficiency in Table C503.4.6.
5. Exempt equipment. Alterations to the following equipment types are not required to comply with this section.
    a. Terminal unit equipment including but not limited to hydronic VAV terminal units, electric resistance VAV boxes, electric duct heaters, water source heat pumps, fan coils, or VRF indoor units, except such modifications to terminal equipment with hydronic heating coils as are required to accommodate lower-temperature fluids circulated from new central heat pump systems in accordance with Section C403.3.8.2.
    b. Air handling equipment with hydronic heating coils, except such modifications to the air handling equipment as are required to accommodate lower-temperature fluids circulated from central heat pump systems in accordance with Section C403.3.8.2.
    c. Replacement of existing steam boilers with steam distribution piping to terminal units and replacement of the existing associated boiler feed equipment.

C503.4.6.1 Hydronic system alteration supply water temperature. Hydronic heating coils and appliances subject to Section C503.4.5 or Section C503.4.6 shall comply with Section C403.3.8.2.

C503.4.6.2 Future decarbonization plan. For buildings with more than 20,000 square feet of conditioned space, a schematic-level design of a heat pump system to replace the existing system shall be prepared by a professional engineer and submitted to SDCI. The professional engineer must be identified on the schematic design documents, but the engineer's signature and date is not required, and no party is obligated to provide any further development of the schematic design. Documents submitted with the schematic design must include:

1. Completed SDCI decarbonization planning form, available on the SDCI website.
2. Mechanical and electrical one-line system diagrams, showing only the impacted portions of systems.
3. Equipment sized and laid out to scale on plans of the existing facility. Only the impacted areas need be depicted, at a simple schematic level of detail.
4. Required louvers, ducts, and air handling equipment.
5. Required structural modifications.
6. Required partitions, doors, and other architectural modifications.

7. Required electrical infrastructure, including any electrical service upgrade and vault.
8. Schematic-level cost estimate, AACE Class 5, or equivalent, including separate line items for structural, mechanical, electrical, architectural, and utility costs.
9. Applicable compliance dates for Washington State Clean Buildings Performance Standards and Seattle Building Emissions Performance Standards (BEPS) with maximum allowable energy use index (EUI) and carbon emissions.

Table C503.4.6
Compliance Options for ((~~Mechanical~~)) HVAC Heating Equipment Alterations

	Proposed Heating Equipment Type[a]	Heating Efficiency Table Reference	Alternate Compliance Options to Section C403.1.4
1	Air-Cooled Unitary Heat Pumps	Table C403.3.2(2)	1. Compliance with C403.1.4, except heat pump rated capacity in accordance with Section C403.1.4 exception 5d is permitted to be sized equal to the supplemental internal resistance heating capacity in Climate Zone 4 or 5[c] 2. Compliance with C403.1.4, except electric resistance mixed air preheat is permissible[c]
2	Packaged terminal, single-package vertical, and room air-conditioner heat pumps	Table C403.3.2(4)	1. Compliance with C403.1.4, except heat pump rated capacity in accordance with Section C403.1.4 Exception 5d is permitted to be sized equal to the supplemental internal resistance heating capacity in Climate Zone 4 or 5
3	Furnaces, duct furnaces, and unit heaters	Table C403.3.2(5)	1. Permitted only when qualifying for and complying with Section C503.4.6 Exceptions 1, 2, 3 or 4 2. Efficiency: ((~~+10%~~)) +5%[b]
4	Gas-fired hot water boilers	Table C403.3.2(6)	1. Permitted only when qualifying for and complying with Section C503.4.6 Exceptions 1, 2, 3 or 4 2. Efficiency: +5%[b]
5	Variable refrigerant flow air-to-air and applied heat pumps	Table C403.3.2(9)	No alternate compliance option
6	DX-DOAS equipment	Table C403.3.2(12) and Table C403.3.2(13)	1. DX-DOAS is provided with heat recovery if not required by C403.3.5.1.
7	Water-source heat pumps	Table C403.3.2(14)	No alternate compliance option

a Includes replacement of equipment with a unit that is the same type or higher efficiency and the same or lower capacity, or a replacement of one equipment type with a different equipment type.

b Equipment shall have a capacity-weighted average heating system efficiency that is 5 percent better than that shown in the reference table (1.05 x values in reference table).

c Option 1 and Option 2 can be combined.

C503.5 New Service water heating equipment. All new service water heating systems shall comply with Section C404.

C503.5.1 Addition or replacement of service water heating equipment. All existing service hot water systems, equipment, and components of existing systems that are altered or replaced shall comply with Section C404 or Section C407 ((~~or Sections C404, C408.3, C409.5~~)) and in all cases with C506.1, and C501.6. Additions or alterations shall not be made to an existing service water heating system that will cause the existing system to become out of compliance. Where use of heat pump equipment for space heating is required by this section, it is permissible to utilize the Fossil Fuel Compliance Path in Section C401.3 to attain the credits required for building additions shown in Table C401.3.3.

EXCEPTIONS: ((~~The following equipment is not required to comply with Section C404.2.1~~))

1. ((~~Reserved.~~)) Utility service upgrade. Compliance with Section C403.1.4 is not required where the requirements of Section C503.4.6.2 are met, and where such compliance would trigger an unplanned utility electrical service upgrade, based on the Seattle Electrical Code Section 220.87 method for determining existing loads, where one or more of the following is required:
   a. A new utility transformer vault located in the existing building or on the site, or an enlargement of the floor area of such a vault.
   b. Trenching across the vehicle lanes of a public way.
   c. The estimated construction cost for the required electrical service enlargement exceeds 50 percent of the project valuation for the remainder of the work, as determined in accordance with the *fee subtitle*. Construction cost shall be documented by an AACE Level 3 or equivalent cost estimate, including required demolition, construction, site work, and utility fees.

The replacement equipment shall comply with the minimum efficiency in Table C503.4.6.

2. Exempt Systems. Replacement of any of the following water heater appliances is not required to comply with this section or with Section C404.2.1:
   2.1. Electric water heaters with an input of ((~~12~~)) 24 kW or less.
   2.2. Gas storage water heaters with an input of 75,000 Btu/h or less.
   2.3. Gas instantaneous water heaters with an input of 200,000 Btu/h or less and 2 gallons or less of storage.
   2.4. Replacement of existing steam boilers with steam distribution piping to terminal units and replacement of the existing associated boiler feed equipment.
3. (Reserved)
4. Exempt buildings. Replacement service water heating equipment for the following buildings is permitted to use the same fuel type as the existing equipment, provided the new equipment has no lower efficiency and no higher capacity than the existing, and that the requirements of Section C503.4.6.2 are met.
   a. *Affordable housing*.
   b. Group I-1, I-2, or I-3 occupancies.
   c. Buildings with more than 50 percent of conditioned floor area occupied by organizations recognized as nonprofit by the State of Washington or by federal tax law.
   d. Buildings smaller than 20,000 square feet.
5. Retention of portion of existing system capacity. A maximum of 50 percent of the existing central fossil fuel or electric resistance water heating capacity is permitted to be provided as supplemental heat for the new heat pump water heating system, provided that the supplemental heat is controlled to be used only when the heat pump system capacity is insufficient to meet the load, in compliance with Section C404.2.1.4, and that the requirements of Section C503.4.6.2 are met. Where an alteration replaces less than 50 percent of the existing fossil fuel or electric resistance service water heating capacity, the remaining service water heating appliances are permitted to be retained. Where the alteration project decreases the peak service water heating load, the fossil fuel or electric resistance heating capacity shall be limited to 50 percent of the calculated peak heating load.
6. Temporary replacement of failing equipment. Temporary like-for-like replacement of one or more service water heating appliances, in excess of the 50 percent capacity permitted by Exception 5 above, is permitted where those appliances require immediate replacement, and where no other work on the service water heating system is planned. When using this exception, it is acceptable to replace a single appliance with two or more smaller appliances, provided the total capacity is not greater than that of the original appliance. In addition, the requirements of Section C503.4.6.2 shall be met, and the applicant shall ensure completion of the required heat pump water heating system in compliance with one of the following options.
   a. SDCI will issue a temporary certificate of occupancy (TCO), which will remain in force until the heat pump water heating system is installed and the final inspection of the system has been completed.
   b. Applicant shall post a performance bond in the amount of the full estimated cost of installation of the required heat pump water heating system, to ensure completion of the system within 48 months.

C503.6 Pools and permanent spas. All new systems and equipment serving pools and permanent spas and components of existing systems that are altered or replaced, shall comply with Sections C404.11, C408.3, ((~~C409.5~~)) C506.1, and C501.6. Additions or alterations shall not be made to an existing system serving a pool or spa that will cause the existing system to become out of compliance.

C503.7 Electrical power and lighting systems and motors. Alterations or the addition of lighting, receptacles and motors shall comply with Sections C503.7.1 through C503.7.7. Additions or alterations shall not be made to an existing lighting or electrical system that will cause the existing system to become out of compliance.

C503.7.1 New lighting ((~~systems and~~)) system controls. All new interior and exterior lighting systems within an existing building site shall be provided with lighting controls in accordance with Section C405.2 and shall comply with C408.4, ((~~C409.5~~)) C506.1, and C501.6.

C503.7.2 Luminaire additions and alterations. Alterations that add or replace 20 percent or more of the luminaires, or of the lamps plus ballasts alone, in a space enclosed by walls or ceiling-height partitions, replace 20 percent or more of parking garage luminaires, or replace 20 percent or more of the total installed wattage of exterior luminaires shall comply with Sections C405.4 and C405.5. Exterior power allowance shall be determined using the specific area allowances for the areas altered and shall not include the base site allowance. Where less than 20 percent of the fixtures in an interior space enclosed by walls or ceiling-height partitions or in a parking garage are added or replaced, or less than 20 percent of the installed exterior wattage is replaced, the installed lighting wattage shall be maintained or reduced.

C503.7.3 Rewiring and recircuiting. Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit, lighting controls shall comply with all applicable requirements in accordance with Sections C405.2.1, C405.2.3, C405.2.4, C405.2.5, C405.2.6, C405.2.7, C405.2.8, C408.4, and C501.6.

C503.7.4 New or moved lighting panel. Where a new lighting panel (or a moved lighting panel) with all new raceway and conductor wiring from the panel to the fixtures is being installed, lighting controls shall also comply with, in addition to the requirements of Section C503.7.3, all ((~~remaining~~)) requirements in Sections C405.2, C408.4, and C501.6.

C503.7.5 Newly-created rooms. Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall have lighting controls that comply with all applicable requirements in accordance with Sections C405.2.1, C405.2.2, C405.2.3, C405.2.4, C405.2.5, C405.2.6, C408.4 and C501.6.

C503.7.6 Motors. Motors that are altered or replaced shall comply with Section C405.8. In no case shall the energy efficiency of the building be decreased.

C503.7.7 Controlled receptacles. Where electric receptacles are added or replaced, controlled receptacles shall be provided in accordance with Section C405.10 and shall comply with Sections C408.4 and C501.6.f

EXCEPTIONS:

1. Where an alteration project impacts an area smaller than 5,000 square feet, controlled receptacles are not required.
2. Where existing systems furniture or partial-height relocatable office cubical partitions are reconfigured or relocated within the same area, controlled receptacles are not required in the existing systems furniture or office cubicle partitions.
3. Where new or altered receptacles meet ((~~the exception~~)) Exception 1 to Section C405.10, they are not required to be controlled receptacles or be located within 12 inches of noncontrolled receptacles.

C503.8 Refrigeration systems. Components of existing refrigeration systems that are altered or replaced shall comply with Sections C408.7, C410 and C501.6. Additions or alterations shall not be made to an existing refrigeration system that will cause the existing system to become out of compliance. All new refrigerated spaces and refrigeration systems and equipment in existing buildings, including new refrigerated display cases, shall comply with Sections C408.7, ((~~C409.5~~)) C506.1, C410 and C501.6.

C503.9 Substantial alterations or repairs. In addition to meeting the requirements of this code, any building or structure to which substantial alterations or repairs are made shall comply with the requirements of this section. Compliance with Sections C502, C503, and C504 is not required.

EXCEPTIONS:

1. *Alterations* and repairs to *landmark* buildings shall comply with this section to the extent that the *code official* determines that such compliance does not have an adverse effect on the designated historic features of the building. The energy use allowed by subsections 2, 3 or 4 of Section C503.9.3 is permitted to be increased in proportion to the additional energy use required for preservation of such designated features.
2. A project that is defined as a substantial alteration primarily due to the seismic retrofitting of a building's unreinforced masonry walls is exempt from the requirements of this section.
3. A building constructed in compliance with the 2003 or more recent edition of the Seattle Building Code that would be classified as a substantial alteration only due to being reoccupied after being substantially vacant for more than 24 months is exempt from the requirements of this section.

C503.9.1 Definition. For the purposes of this section, substantial alterations or repairs means items 1, 2 or 4, or any combination thereof, of the definition of substantial alterations or repairs in Chapter 3 of the Seattle amendments to the IEBC, as determined by the *code official*.

SDCI Informative Note. Alterations that convert HVAC heating systems, water heating systems, or both from fossil fuel or electric resistance to heat pump systems, and where the only additional alterations provide necessary electrical power, structural support, or air circulation for the heat pump system, might in certain cases not be classified as substantial alterations. Consult with your SDCI Building Code reviewer, and see additional guidance in SDCI Tip 314.

SDCI Informative Note: Definitions 1, 2 and 4 of "substantial alterations or repairs" in the Seattle Existing Building Code are as follows:

1. Repair of a building with a damage ratio of 60 percent or more.
2. Remodeling or *additions* that substantially extend the useful physical and/or economic life of the building or a significant portion of the building, other than typical tenant remodeling.

4. Re-occupancy of a building that has been substantially vacant for more than 24 months in occupancies other than Group R-3.

C503.9.2 Pre-submittal conference. The applicant shall attend a pre-submittal conference to discuss the selected compliance path. Prior to this conference, the applicant shall meet with each energy utility serving the building to determine whether technical assistance or financial incentives are available for energy efficiency upgrades, and shall submit documentation of these meetings at the pre-submittal conference.

C503.9.3 Energy efficiency. Buildings undergoing substantial alterations shall comply with Section C503.4.6 and one of the following:

1. Full code compliance. Fully comply with the requirements of this code for new construction, including Section C406.
2. Envelope thermal performance within 15 percent of code. Demonstrate that heat loss through the building envelope is no more than 15 percent greater than allowed by the Seattle Energy Code, using the Component Performance Building Envelope Option in Section C402.1.5, and meet all other prescriptive requirements of the Seattle Energy Code for new construction, including Section C406.
   2.1. Default U-values. The values listed in Appendix A and Section C303 shall be used as the default U-values for existing building envelope components. For buildings whose original construction permits were applied for after January 1, 1992, existing building envelope components are deemed to meet the minimum U-values required by the edition of the Seattle Energy Code in effect at the time of permit application, where visual inspection by the *code official* reveals that those components appear to be equal to or better than code-compliant components.
   2.2. Disproportionality. Where *approved* by the *code official*, the cost of required thermal improvements to the building envelope are not required to exceed 20 percent of the valuation of the substantial alterations project, determined in accordance with the Fee Subtitle, when using this envelope thermal performance compliance method. Envelope improvement costs shall be documented using standard cost estimating software and methodology.
3. Total building performance within 10 percent of code. Demonstrate that the Building Performance Factor is no more than 10 percent higher than that permitted by Table C407.3(2).

   EXCEPTION: The UxA calculation required by Section C407.3.1 is not required when using this option.
4. Operating energy alternative. The *code official* is permitted to allow calculated building performance factor 20 percent greater than the baseline building design calculated in accordance with the Total Building Performance methodology in Section C407, provided that:
   a. The applicant demonstrates that constructability, economic, or historic preservation considerations preclude conformance with any of the above options; and
   b. The owner agrees to operate the building at or below the annual energy use level predicted for that calculated energy performance during a period of 12 consecutive months, concluding no later than three years after issuance of the certificate of occupancy, adjusted as allowed by Sections C401.4.7 through C401.4.11, and to meet the requirements of Sections C401.4.12 through C401.4.14, substituting the energy consumption standard in option 4 of this Section C503.9.3 for the energy consumption targets set out in Section C401.4.2.
   4.1. Reporting. The building owner shall report the energy consumption in kBTU/square foot using automated reporting directly from utilities via Energy Star Portfolio Manager, and shall authorize the *code official* to view the reports directly in Portfolio Manager during the demonstration period.

C503.9.4 Impracticality. In cases where full compliance with all the requirements of Section C503.9 is impractical, the applicant is permitted to arrange a pre-application conference with the design team and the *code official* to seek modifications. The applicant shall identify specific requirements that are impractical, and shall identify design solutions and modifications that achieve a comparable level of energy efficiency. The *code official* is authorized to waive specific requirements in this code to the extent that the *code official* determines those requirements to be impractical.

SECTION C504
REPAIRS

C504.1 General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required

by Section C501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

C504.2 Application. For the purposes of this code, the following shall be considered repairs.

1. Glass only replacements in an existing sash and frame.
2. *Roof repairs*.
3. Air barriers shall not be required for *roof repair* where the repairs to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
4. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided however that an existing vestibule that separates a conditioned space from the exterior shall not be removed.
5. *Repairs* where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

SECTION C505
CHANGE OF SPACE CONDITIONING, OCCUPANCY OR USE

C505.1 General. Buildings or spaces undergoing a change in space conditioning alteration shall comply with Sections C505.1.1, C505.1.2, C505.2 and C505.4. Buildings or spaces undergoing a change in occupancy ((~~alterations~~)) alteration shall comply with Sections C505.1.1, C505.1.2, C505.3 and C505.4. Spaces changing from one use type to another shall also comply with Section C505.5.

Buildings or spaces undergoing a change in space conditioning, change in occupancy or change in use shall conform to the provisions of this code without requiring the unaltered portion of the existing building to comply with this code. Alterations shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the alteration.

((~~A change in space conditioning alteration shall be deemed to comply with this code if the alteration area alone complies or if the alteration area is combined with all other spaces within the existing building that are of the same space conditioning category according to Section C505.2 to demonstrate compliance. A change in occupancy alteration shall be deemed to comply with this code if the alteration area alone complies or if the existing building and the alteration area are combined to demonstrate complete for the whole building. This allowance applies to prescriptive compliance in accordance with Section C505.4 or total building performance in accordance with Section C407.~~))

Buildings or spaces ((~~that were permitted prior to the 2009 Washington State energy code, or were originally permitted as unconditioned, may comply with this section as follows~~)) are permitted to utilize one of the following modifications for compliance with this section:

1. Increased envelope UA with prescriptive compliance. Where the component performance alternative in Section C402.1.5 is used to demonstrate compliance with this section, and the project area complies with all other requirements of this code, the Proposed Total UA is allowed to be up to 110 percent of the Allowable Total UA. This exception ((~~may~~)) is permitted to be applied to the project area alone, or to the existing building and project area combined as a whole building.
2. Increased site energy use with total building performance compliance. Where total building performance in accordance with Section C407 is used to demonstrate compliance with this section, the total annual ((~~carbon emissions from~~)) energy consumption of the proposed design is allowed to be up to 110 percent of the annual ((~~carbon emissions from~~)) energy consumption allowed by Section C407.3. This exception ((~~may~~)) is permitted to be applied to the project area alone, or to the existing building and project area combined as a whole building.

C505.1.1 Additional energy efficiency credits. Buildings or spaces that are required to comply with Sections C505.2 or C505.3 shall also comply with Section C502.1.1 in the same manner as an addition.

C505.1.2 Renewable energy. Buildings or spaces that are required to comply with Section C505.2 or C505.3 shall also comply with Section C502.1.2 in the same manner as an addition.

C505.2 Change in space conditioning. For the purposes of this section, space conditioning area categories include: low energy space in accordance with Section C402.1.1.1, *semi-heated space*, and *conditioned space*. Spaces undergoing a change in space conditioning alteration shall be brought up to full compliance with this code, other than Sections C502, C503, and C504, for all disciplines in the following cases:

1. Any low energy space in accordance with Section C402.1.1.1 that is altered to become *conditioned space* or *semi-heated space*, ((~~shall be brought into full compliance with this code.~~))

2. Any semi-heated space in accordance with Section C402.1.1.2 that is altered to become conditioned space or any heated but not cooled space that is altered to become both heated and cooled. ((~~shall be brought into full compliance with this code.~~

~~For buildings with more than one space conditioning category, the interior partition walls, ceilings, floors and fenestration that separate space conditioning areas shall comply with the thermal envelope requirements per the area with the highest level of space conditioning.~~

~~A change in space conditioning project shall be deemed to comply with this code if the project area alone complies or if the existing building and the project area combined comply with this code as a whole building.~~))

Interior walls, ceilings, floors and fenestration that separate conditioned spaces from low energy or semi-heated spaces shall comply with the thermal envelope requirements for conditioned space. Interior walls, ceilings, floors and fenestration that separate semi-heated spaces from low energy spaces shall comply with the thermal envelope requirements for semi-heated space.

A change in space conditioning is permitted to demonstrate compliance either if the alteration area alone complies or if the alteration area combined with all existing spaces of the same space conditioning area category complies. This applies to either prescriptive compliance in accordance with Section C505.4 or total building performance in accordance with Section C407.

EXCEPTIONS:

1. A change in space conditioning does not require full compliance with this code if the existing heated but not cooled space is altered to become both heated and cooled solely by replacement of the existing heating-only HVAC system with an electric heat pump HVAC system, provided that there is no change in the use or occupancy classification of the area served by the HVAC system that would increase the cooling load, and the new system includes a DOAS with energy recovery in compliance with Section C403.3.5.
2. The addition of cooling equipment to an already-conditioned floor area of less than 2,000 square feet does not trigger the requirement to comply with this Section 505.2.

C505.3 Change in occupancy. Spaces undergoing a change in occupancy alteration shall be brought up to full compliance with this code, other than Sections C502, C503, and C504, for all disciplines in the following cases:

1. Any space that is converted from a Group F, S or U occupancy to an occupancy other than Group F, S or U.
2. Any space that is converted to a Group R dwelling unit or portion thereof, from another use or occupancy.
3. Any Group R dwelling unit or portion thereof permitted prior to July 1, 2002, that is converted to a commercial use or occupancy.

A change in occupancy is permitted to demonstrate compliance either if the alteration area alone complies or if the alteration area combined with all existing spaces of the same space conditioning area category complies. This applies to either prescriptive compliance in accordance with Section C505.4 or total building performance in accordance with Section C407.

C505.4 Prescriptive compliance. Change in space conditioning and change in occupancy shall comply with Sections C505.4.1 through C505.4.6.

C505.4.1 Vertical fenestration. ((~~A~~)) Either a change in space conditioning or change in occupancy ((~~alteration~~)) to a space or building with vertical fenestration shall comply with the following:

1. Where the vertical fenestration area of the alteration combined with the vertical fenestration area of all equivalent space conditioning areas in the existing building results in a total vertical fenestration area that is less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the vertical fenestration area of the alteration combined with the vertical fenestration area of all equivalent space conditioning areas in the existing building results in a total vertical fenestration area that is greater than the maximum allowed by Section C402.4.1, the alteration shall comply with one of the following:
   2.1. Component performance alternative with target area adjustment in accordance with Section C402.1.5 for the alteration area of the building only.
   2.2. Alteration area is combined with all equivalent space conditioning areas to demonstrate compliance with the component performance alternative.
   2.3. Total building performance in accordance with Section C407 for the alteration area of the building only.
   2.4. Alteration area is combined with all equivalent space conditioning areas to demonstrate total building performance compliance.
   2.5. The alteration does not increase the existing fenestration area.

C505.4.1.2 Skylights. ((~~A~~)) Either a change in space conditioning ((~~alteration~~)) or change in occupancy to a space or building with skylights shall comply with the following:

1. Where the skylight area of the alteration combined with the skylight area of all equivalent space conditioning areas in the existing building results in a total skylight area that is less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the skylight area of the alteration combined with the skylight area of all equivalent space conditioning areas in the existing building results in a total skylight area that is greater than the maximum allowed by Section C402.4.1, the alteration shall comply with one of the following:
   2.1. Component performance alternative with target area adjustment in accordance with Section C402.1.5 for the alteration area of the building only.
   2.2. Alteration area is combined with all equivalent space conditioning areas to demonstrate compliance with the component performance alternative.
   2.3. Total building performance in accordance with Section C407 for the alteration area of the building only.
   2.4. Alteration area is combined with all equivalent space conditioning areas to demonstrate total building performance compliance.

C505.4.2 Building mechanical systems. All new and existing mechanical systems and equipment that serve the new building heating, cooling and ventilation needs of the alteration area shall comply with Sections C403, C408.2, ((~~C409.5~~)) C506.1 and C501.6.

C505.4.3 Service water-heating systems. All new and existing service water-heating systems and equipment that serve the new service water-heating needs of the alteration area shall comply with Sections C404, C408.3, ((~~C409.5~~)) C506.1 and C501.6.

C505.4.4 Pools and permanent spas. All new and existing systems and equipment serving pools and permanent spas that are included in the alteration shall comply with Sections C404.11, C408.3, ((~~C409.5~~)) C506.1 and C501.6.

C505.4.5 Electrical power and lighting systems and motors. All new and existing electrical power and lighting systems and motors that are included in the alteration shall comply with Sections C405, C408.4, ((~~C409.5~~)) C506.1 and C501.6.

C505.4.6 Refrigeration systems. All new and existing refrigerated spaces and refrigeration systems and equipment that serve the new refrigeration needs of the alteration area shall comply with Sections C410, C408.7, ((~~C409.5~~)) C506.1 and C501.6.

C505.5 Change of use. Where the use in a space changes from one use in Table C405.4.2 (1) or (2) to another use in Table C405.4.2 (1) or (2), the installed lighting wattage in the space shall comply with Section C405.4 and the ventilation air flow provided to the space shall be in accordance with Chapter 4 of the International Mechanical Code.

SECTION C506
METERING FOR EXISTING BUILDINGS

C506.1 Existing buildings that were constructed subject to the requirements of this section. Where new or replacement systems or equipment are installed in an existing building that was constructed subject to the requirements of this section, metering shall be provided for such new or replacement systems or equipment so that their energy use is included in the corresponding end-use category defined in Section C409.2. This includes systems or equipment added in conjunction with additions or alterations to existing buildings.

C506.1.1 Small existing buildings. Metering and data acquisition systems shall be provided for additions over 25,000 square feet to buildings that were constructed subject to the requirements of this section, in accordance with the requirements of Sections C409.2 and C409.3.

C506.2 Metering for the addition or replacement of HVAC equipment in existing buildings. Where HVAC equipment is added or replaced, metering shall be provided according to Sections C506.2.1 or C506.2.2, as applicable.

C506.2.1 Addition or replacement of individual HVAC equipment pieces. Where HVAC equipment is added or replaced, but compliance with Section C506.2.2 is not required, metering shall be provided as follows, and the data from these meters is permitted to either be stored locally using a manual totalizing meter or other means at the meter or fed into a central data collection system.

1. Electrical metering shall be provided for all of the following:
   a. Each new or existing branch circuit serving a new piece of HVAC equipment with minimum circuit ampacity (MCA) that equates to 50 kVA or more. A single meter is permitted to serve multiple circuits of the same sub-metering category from Section C409.3.
   b. Each new or existing branch circuit supplied by a new electrical panel that is dedicated to serving HVAC equipment. It shall be permitted to meter the circuits individually or in aggregate.

c. Each new HVAC fan or pump on a variable speed drive, where the fan, pump, or variable speed drive are new, unless the variable speed drive is integral to a packaged HVAC unit or the existing variable speed drive does not have the capability to provide electric metering output.

2. Natural gas metering shall be provided for each new natural gas connection that is rated at 1,000 kBTU or higher. A single meter is permitted to serve multiple equipment pieces of the same sub-metering category from Section C409.3; HVAC, water heating or process.

C506.2.2 Addition or replacement of the majority of HVAC equipment in a building. Where permits are issued for new or replacement HVAC equipment that has a total heating and cooling capacity greater than 1,200 kBTU/hour and greater than 50 percent of the building's existing HVAC heating and cooling capacity, within any 12-month period, the following shall be provided for the building:

1. Energy source metering required by Section C409.2.
2. HVAC system end-use metering required by Section C409.3.1
3. Data acquisition and display system per the requirements of Section C409.4.

Each of the building's existing HVAC chillers, boilers, cooling towers, air handlers, packaged units and heat pumps that has a capacity larger than 5 tons or that represents more than 10 percent of the total heating and cooling capacity of the building shall be included in the calculation of the existing heating and cooling capacity of the building. Where heat pumps are configured to deliver both heating and cooling, the heating and cooling capacities shall both be included in the calculation of the total capacity.

Each of the building's existing and new HVAC chillers, boilers, cooling towers, air handlers, packaged units and heat pumps that has a heating or cooling capacity larger than 5 tons or that represents more than 10 percent of the total heating and cooling capacity of the building shall be included in the HVAC system end-use metering.

Construction documents for new or replacement heating and cooling equipment projects shall indicate the total heating and cooling capacity of the building's existing HVAC equipment and the total heating and cooling capacity of the new or replacement equipment. Where permits have been issued for new or replacement heating and cooling equipment within the 12 month period prior to the permit application date, the heating and cooling capacity of that equipment shall also be indicated. For the purpose of this tabulation, heating and cooling capacities of all equipment shall be expressed in kBTU/hour.

C506.3 Tenant space electrical sub-metering for existing buildings. For tenant improvements in which a single tenant will occupy a full floor or multiple floors of a building, the electrical consumption for the tenant space on that floor shall be separately metered, and the metering data provided to the tenant with a display system per the requirements of Section C409.4.3. For the purposes of this section, separate end use categories need not be segregated.

EXCEPTION: Where an existing branch circuit electrical panel serves tenant spaces on multiple full floors of a building, the floors served by that panel are not required to comply with this section.

C506.4 Metering for complete electrical system replacement. If all, or substantially all, of the existing electrical system is replaced under a single electrical permit or within a 12-month period, all of the provisions of Section C409 shall be met.

Chapter 6 [CE]

REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section C106.

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-4268

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A C440—17	North American Fenestration Standard/Specifications for Windows, Doors and Unit Skylights	Table C402.4.1.1.2

AHAM

Association of Home Appliance Manufacturers
1111 19th Street, N.W., Suite 402
Washington, D.C. 20036

Standard reference number	Title	Referenced in code section number
ANSI/AHAM RAC-1—2008	Room Air Conditioners	C403.3.2(((~~(3)~~))) (4)
AHAM HRF-1—2017	Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers	Table C410.1(1)

AHRI

Air Conditioning, Heating, and Refrigeration Institute
4100 North Fairfax Drive, Suite 200
Arlington, VA 22203

Standard reference number	Title	Referenced in code section number
ISO/AHRI/ASHRAE 5801—2017	Fans—Performance Testing Using Standardized Airways	C403.8.1.1
ISO/AHRI/ASHRAE 13256-1 (2017)	Water-source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-air and Brine-to-air Heat Pumps	Table C403.3.2(14)
ISO/AHRI/ASHRAE 13256-2 (2017)	Water-source Heat Pumps—Testing and Rating for Performance—Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.3.2(14)
210/240—(2017 and 2023)	Performance Rating of Unitary Air Conditioning and Air-source Heat Pump Equipment	Table C403.3.2(1), Table C403.3.2(2)
310/380—2017	Standard for Packaged Terminal Air Conditioners and Heat Pumps	Table C403.3.2(4)
340/360—2018	Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment	Table C403.3.2(1), Table C403.3.2(2)

ANSI—continued

ANSI/ASME A17.1—2010	Safety code for elevators and escalators	C405.12.1
ANSI/CTA 2045-A—2018	Modular Communications Interface for Energy Management	C404.14
ANSI/CTA 2045-B—2021	Modular Communications Interface for Energy Management	C404.14
Z21.10.3/CSA 4.3—((~~11~~)) 17	Gas Water Heaters, Volume III—Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating Tank and Instantaneous	Table C404.2
Z21.47/CSA 2.3 16	Gas-fired Central Furnaces	Table C403.3.2(5)
Z83.8/CSA 2.6—16	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces	Table C403.3.2(5)

APSP

The Association of Pool and Spa Professionals
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
14— 2019	American National Standards for Portable Electric Spa Efficiency	C404.12

ASABE

American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085

Standard reference number	Title	Referenced in code section number
S640—2017	Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)	C405.3

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, N.E.
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/ACCA Standard 127-2007	Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners	((~~Table C403.3.2(9)~~)) C403.5
ANSI/ASHRAE/ACCA Standard 183—((~~2007~~)) RA2017	Peak Cooling and Heating Load Calculations in Buildings, Except Low-rise Residential Buildings	((~~Table C403.3.2(9)~~)) C403.5, C403.1.2
ASHRAE—((~~2016~~)) 2020	ASHRAE HVAC Systems and Equipment Handbook—((~~2016~~)) 2020	C403.1.2
ISO/AHRI/ASHRAE 13256-1 (((~~2011~~)) 2012)	Water-source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-air and Brine-to-air Heat Pumps	Table C403.3.2((~~(2)~~)) (14)
ISO/AHRI/ASHRAE 13256-2 (((~~2011~~)) 2012)	Water-source Heat Pumps—Testing and Rating for Performance—Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.3.2((~~(2)~~)) (14)

ASHRAE—continued

90.1—((2016)) 2022	Energy Standard for Buildings Except Low-rise Residential Buildings (ANSI/ASHRAE/IESNA 90.1—((2010)) 2022	Table C402.1.3, Table C402.1.4, C406.2
90.4—((2019)) 2022	Energy Standard for Data Centers (with Addenda a, b, d, e)	C403.1.3
146—2011	Testing and Rating Pool Heaters	Table C404.2

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
ASME A17.1/CSA B44—((2016)) 2019	Safety Code for Elevators and Escalators	C405.9.2
BPVC Section IV-2021	Boiler and Pressure Vessel Code, Section IV—Rules for Construction of Heating Boilers	C404.14
BPVC Section X-2021	Boiler and Pressure Vessel Code, Section X—Fiber-Reinforced Plastic Pressure Vessels	C404.14

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2859

Standard reference number	Title	Referenced in code section number
C 90—((14)) 206A	Specification for Load-bearing Concrete Masonry Units	Table C402.1.3
C518—17	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	Table C403.10.1.1
C1363—11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	C303.1.4.1, Table C402.1.4
C1363—11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	C303.1.4.1, Table C402.1.4, C402.2.7
C 1371—15	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	Table C402.4
C 1549—09	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using A Portable Solar Reflectometer	Table C402.4
D 1003—13	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	C402.4.2.2
E 283—04 (2012)	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	C402.5.8
E 408—13	Test Methods for Total Normal Emittance of Surfaces Using Inspection-meter Techniques	Table ((C402.4)) C402.3
E 779—((10)) 2018	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	C402.5.1.2.3
E 903—12	Standard Test Method Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)	Table C402.4
E 1677—11	Standard Specification for an Air-retarder (AR) Material or System for Low-rise Framed Building Walls	C402.5.1.2.2
E 1827—2011(2017)	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door	C402.5.2, C402.5.3

ASTM—continued

E 1918—06 (2015)	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field	Table C402.4
E 1980—11	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-sloped Opaque Surfaces	Table C402.2.1.1
E 2178—13	Standard Test Method for Air Permanence of Building Materials	C402.4
E 2357—11	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies	C402.5.1.2.2
F 1281—2017	Specification for Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL_PEX) Pressure Pipe	Table C404.5.2.1

CSA

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario, Canada L4W 5N6

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	Table C402.4.2
CSA B55.1—2015	Test Method for Measuring Efficiency and Pressure Loss of DWHR Units	C404.10
CSA B55.2—2015	Drain Water Heat Recovery Units	C404.10

CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland OH 44131-5516

Standard reference number	Title	Referenced in code section number
CAN/CSA-C439-18	Laboratory methods of test for rating the performance of heat/energy-recovery ventilators	Table C403.8.4

CTA

Consumer Technology Association
1919 S Eads Street
Arlington, VA 22202

Standard reference number	Title	Referenced in code section number
ANSI/CTA 2045-A—2018	Modular Communications Interface for Energy Management	C404.14
ANSI/CTA 2045-B—2021	Modular Communications Interface for Energy Management	C404.14

CTI

Cooling Technology Institute
2611 FM 1960 West, Suite A-101
Houston, TX 77068

Standard reference number	Title	Referenced in code section number
ATC 105 (((~~00~~)))—2019	Acceptance Test Code for Water Cooling Tower	Table C403.3.2(((~~8~~))) (7)
ATC 105DS—2018	Acceptance Test Code for Dry Fluid Coolers	Table C403.3.2(7)
ATC 105S—11	Acceptance Test Code for Closed Circuit Cooling Towers	Table C403.3.2(((~~8~~))) (7)

CTI—continued

ATC 106—11	Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers	Table C403.3.2(((~~8~~))) (7)
STD 201—((~~11~~)) 17	Standard for Certification of Water Cooling Towers Thermal Performances	Table C403.3.2(((~~8~~))) (7)

DASMA

Door and Access Systems Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
105—((~~92 (R2004)—13~~)) 17	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	Table C402.4.2

DOE

U.S. Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402-9325

Standard reference number	Title	Referenced in code section number
10 C.F.R., Part 430—2015	Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule	Table C403.3.2(((~~4~~))) (1), Table C403.3.2(((~~5~~))) (2), Table C403.3.2(5), Table C403.3.2(6), Table C403.3.2(14), Table C404.2
((~~10 C.F.R., Part 430, Subpart B, Appendix N—2015~~	~~Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers~~	~~C202~~))
10 C.F.R., Part 431—2015	Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards; Final Rules	Table C403.3.2(((~~5~~))) (6), C403.8.4, C403.11, Table ((~~C406.2(5)~~)) C403.11, C403.11.2, C405.7, Table C405.7, C405.8, Table C405.8(1), Table C405.8(2), Table C405.8(3)
((~~NAECA 87—(88)~~	~~National Appliance Energy Conservation Act 1987 [(Public Law 100-12 (with Amendments of 1988 P.L. 100-357)]~~	~~Tables C403.3.2(1), (2), (4)~~))

HVI

Home Ventilating Institute
1740 Dell Range Blvd., Ste. H, PMB 450
Cheyenne, WY 82009

Standard reference number	Title	Referenced in code section number
920—2020	Product Performance Certification Procedure Including Verification and Challenge	C403.3.5.1, C403.3.6

IAPMO

International Association of Plumbing and Mechanical Officials
4755 E. Philadelphia Street
Ontario, CA 91761

Standard reference number	Title	Referenced in code section number
UPC—((~~2015~~)) 2021	Uniform Plumbing Code	C201.3, ((~~C501.4~~)) C501.2

ICC

International Code Council, Inc.
500 New Jersey Avenue, N.W.,
6th Floor
Washington, D.C. 20001

Standard reference number	Title	Referenced in code section number
IBC—((~~15~~)) 21	International Building Code	C201.3, C303.2, C402.4.3, C501.2
ICC 500—2020	Standard for the Design and Construction of Storm Shelters	C402.4.2
IFC—((~~15~~)) 21	International Fire Code	C201.3, ((~~C501.4~~)) C501.2
IFGC—((~~15~~)) 21	International Fuel Gas Code	C201.3, ((~~C501.4~~)) C501.2
IMC—((~~15~~)) 21	International Mechanical Code	C106.3, C201.3, C402.5.3, C403.2.2.1, C403.2.2.2, C403.3.5, C403.3.5.1, C403.6.1, C403.6.5, C403.6.10, C403.7.1, C403.7.2, C403.7.5, C403.7.5.1, C403.7.6, C403.7.7.3, C403.7.8.1, C403.7.8.4, C403.8.4, C403.8.5.1, Table C403.10.1, C403.10.1.2, Table C403.10.1.2, C403.10.2.2, C403.12, C406.6, C408.2.2.1, ((~~C501.4~~)) C501.2

IEEE

The Institute of Electrical and Electronic Engineers, Inc.
3 Park Avenue
New York, NY 10016

Standard reference number	Title	Referenced in code section number
IEEE 515.1—2012	IEEE Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications	C404.6.2

((~~IESNA~~)) IES

Illuminating Engineering Society ((~~of North America~~))
120 Wall Street, 17th Floor
New York, NY 10005-4001

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/IESNA 90.1—((~~2016~~)) 2019	Energy Standard for Buildings Except Low-rise Residential Buildings	Table C402.1.3, Table C402.1.4, Table C407.5.1

ISO

International Organization for Standardization
1, rue de Varembe, Case postale 56, CH-1211
Geneva, Switzerland

Standard reference number	Title	Referenced in code section number
ISO/AHRI/ASHRAE 13256-1 (2017)	Water-Source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-air and Brine-to-air Heat Pumps	C403.3.2(((~~2~~))) (14)
ISO/AHRI/ASHRAE 13256-2 (2017)	Water-Source Heat Pumps—Testing and Rating for Performance—Part 2: Water-to-water and Brine-to-water Heat Pumps	C403.3.2(((~~2~~))) (14)
25745-2:2015	Energy Performance of Lifts, Escalators and Moving Walks—Part 2: Energy Calculation and Classification for Lifts (Elevators)	C406.2.14

NEEA

Northwest Energy Efficiency Alliance
421 SW 6th Ave.
Suite 600
Portland, OR 97204

Standard reference number	Title	Referenced in code section number
AWHS Vers. 8.0—2022	Advanced Water Heating Specification	C404.2.1

NEMA

National Electric Manufacturers Association
1300 North 17th Street
Suite 1752
Rosslyn, VA 22209

Standard reference number	Title	Referenced in code section number
((~~TP-1-2002~~	~~Guide for Determining Energy Efficiency for Distribution Transformers~~	~~C405.9~~))
ANSI/NEMA WD 6-2016	Wiring Devices—Dimensional Specifications	C405.12
MGI—((~~2014~~)) 2016	Motors and Generators	C202
TP-1-2002	Guide for Determining Energy Efficiency for Distribution Transformers	C405.9

NFRC

National Fenestration Rating Council, Inc.
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770

Standard reference number	Title	Referenced in code section number
100—((~~2017~~)) 2020	Procedure for Determining Fenestration Product U-factors	C303.1.2, C402.2.2
200—((~~2017~~)) 2020	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	C303.1.3, C402.4.1.1
202—2017	Procedure for Determining Fenestration Product Visible Transmittance at Normal Incidence	C202
NFRC 203—2017	Procedure for Determining Visible Transmittance of Tubular Daylighting Devices	C202, C402.4.2
400—2017	Procedure for Determining Fenestration Product Air Leakage	Table C402.4.2

SMACNA

Sheet Metal and Air Conditioning Contractors National Association, Inc.
4021 Lafayette Center Drive
Chantilly, VA 20151-1209

Standard reference number	Title	Referenced in code section number
SMACNA—2012	HVAC Air Duct Leakage Test Manual	C403.10.2.3

UL

Underwriters Laboratories
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
710—12	Exhaust Hoods for Commercial Cooking Equipment	C403.7.5
727—((~~06~~)) 18	Oil-fired Central Furnaces—with Revisions through April 2010	Table C403.3.2(4), Table C403.3.2(5)
731—((~~95~~)) 18	Oil-fired Unit Heaters—with Revisions through April 2010	Table C403.3.2(((~~4~~))) (5)

CHAPTER 1 [RE]
SCOPE AND ADMINISTRATION

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. This code, consisting of Chapter 1 [RE] through Chapter 5 [RE] and Appendices A through C, shall be known as the ((~~*Washington State Energy Code-Residential*~~,)) "Seattle Residential Energy Code," and shall be cited as such. It is referred to herein as "this code."

The 2021 edition of the Washington State Energy Code is hereby adopted. The Washington State Energy Code adopted under chapter 51-11R WAC shall become effective in all counties and cities of this state on March 15, 2024.

SDCI Informative Note: The Seattle Residential Energy Code consists of Chapter 1 [RE] through Chapter 6 [RE] and Appendices A through E.

R101.2 Scope. This code applies to *residential buildings* and the buildings sites and associated systems and equipment. This code shall be the maximum and minimum energy code for residential construction in each town, city and county. Residential *sleeping units*, Group I-1, Condition 2 assisted living facilities licensed by Washington state under chapter 388-78A WAC and Group I-1, Condition 2 residential treatment facilities licensed by Washington state under chapter 246-337 WAC shall utilize the commercial building sections of the energy code regardless of the number of stories of height above grade plane.

R101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

R101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

R101.4.1 Mixed residential and commercial buildings. Where a building includes both *residential* building and *commercial* building portions, each portion shall be separately considered and meet the applicable provisions of the ((~~WSEC~~)) Seattle Energy Code—Commercial Provisions or ((~~WSEC~~)) Seattle Energy Code—Residential Provisions.

R101.5 Compliance. *Residential buildings* shall meet the provisions of ((~~WSEC~~)) Seattle Energy Code—Residential Provisions. *Commercial buildings* shall meet the provisions of ((~~WSEC~~)) Seattle Energy Code—Commercial Provisions.

R101.5.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

R101.6 Landmark buildings. The building official may modify the specific requirements of this code for *landmarks* and require in lieu thereof alternate requirements that the *code official* determines will not have an adverse effect on the designated historic features of the building and will result in a reasonable degree of energy efficiency. A *landmark* is a building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation or has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, has been listed or determined eligible to be listed in the National Register of Historic Places, or is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of the structure.

SECTION R102
ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT

R102.1 General. The provisions of this code ((~~are not intended to~~)) do not prevent the installation of any material or to prohibit any design or method of construction prohibited by this code or not specifically ((~~prescribed~~)) allowed by this code, provided that any such alternative has been *approved*. The code official shall have the authority to approve an alternate material, design or method of construction upon the written application of the owner or the owner's authorized agent. The code official shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code for strength, effectiveness, fire resistance, durability, energy efficiency and safety. The code official shall respond in writing, stating the reasons why the alternative was *approved* or was not *approved*.

The *code official* may approve an alternate material, method of construction, design or insulating system, provided the *code official* finds that the proposed alternate complies with the provisions of this code, and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation.

The *code official* may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The *code official* may, but is not required to, record the approval of modifications and any relevant information in the files of the *code official* or on the approved permit plans.

R102.2 Modifications. The *code official* may modify the requirements of this code for individual cases provided the code *official* finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; (3) the modification will provide a reasonable level of fire protection and structural integrity when considered together with other safety features of the building or other relevant circumstances; and (4) the modification maintains or improves the energy efficiency of the building. The *code official* may, but is not required to, record the approval of modifications and any relevant information in the files of the *code official* or on the approved permit plans.

SECTION R103
((~~CONSTRUCTION DOCUMENTS~~)) APPLICATIONS AND PERMITS

R103.1 General. A permit for work performed according to this code shall be obtained in accordance with Chapter 1 of the International Residential Code, International Building Code, International Mechanical Code or Seattle Electrical Code.

R103.2 Construction documents. Construction documents, technical reports, and other supporting data shall ((~~be submitted in one or more sets, or in a digital format where allowed by the *code official*, with each application for a permit~~)) comply with this section and the International Residential Code, the International Building Code, the International Mechanical Code, the International Existing Buildings Code and the Seattle Electrical Code. ((~~The construction documents and technical reports shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *code official* is authorized to require necessary construction documents to be prepared by a registered design professional.~~

~~Exception:~~ ~~The *code official* is authorized to waive the requirements for construction documents or other supporting data if the *code official* determines they are not necessary to confirm compliance with this code.~~))

R103.2.1 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Energy compliance path per Section R401.2.
2. Insulation materials and their *R*-values.
3. Fenestration *U*-factors and SHGCs.
4. Area-weighted *U*-factor and SHGC calculations.
5. Mechanical system design criteria.
6. Mechanical and service water heating system and equipment types, sizes and efficiencies.
7. Equipment and systems controls
8. Duct sealing, duct and pipe insulation and location.
9. Air sealing details.

((~~R103.2.1~~)) R103.2.2 Building thermal envelope depiction. The building's thermal envelope shall be represented on the construction documents.

((~~**R103.3 Examination of documents.** The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. The code official is authorized to utilize a registered design professional or other approved entity not affiliated with the building design or construction in conducting the review of the plans and specifications for compliance with the code.~~

~~**R103.3.1 Approval of construction documents.** When the *code official* issues a permit where construction documents are required, the construction documents shall be endorsed in writing and stamped "Reviewed for Code Compliance." Such *approved* construction documents shall not be changed, modified or altered without authorization from the *code official*. Work shall be done in accordance with the *approved* construction documents.~~

~~One set of construction documents so reviewed shall be retained by the *code official*. The other set shall be returned to the applicant, kept at the site of work and shall be open to inspection by the *code official* or a duly authorized representative.~~

~~**R103.3.2 Previous approvals.** This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.~~

~~**R103.3.3 Phased approval.** The *code official* shall have the authority to issue a permit for the construction of part of an energy conservation system before the construction documents for the entire system have been submitted or *approved*, provided adequate information and detailed statements have been filed complying with all pertinent requirements of this code. The holders of such permit shall proceed at their own risk without assurance that the permit for the entire energy conservation system will be granted.~~

~~**R103.4 Amended construction documents.** Work shall be installed in accordance with the *approved* construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.~~

~~**R103.5 Retention of construction documents.** One set of *approved* construction documents shall be retained by the *code official* for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.~~))

SECTION R104
FEES

R104.1 Fees. ((~~A permit shall not be issued until the fees prescribed in Section R104.2 have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.~~)) A fee for each permit and for other activities related to the enforcement of this code shall be paid as set forth in the Fee Subtitle, Seattle Municipal Code Title 22, Subtitle IX.

~~((**R104.2 Schedule of permit fees.** A fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.~~

~~**R104.3 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to an additional fee established by the *code official*, which shall be in addition to the required permit fees.~~

~~**R104.4 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.~~

~~**R104.5 Refunds.** The *code official* is authorized to establish a refund policy.~~))

SECTION R105
INSPECTIONS

R105.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official* ((~~or his or her designated agent, and such construction or work shall remain visible and able to be accessed for inspection purposes until *approved*~~)) in accordance with this section, the International Residential Code or International Building Code, and the Seattle Electrical Code. ((~~It shall be the duty of the permit applicant to cause the work to remain visible and able to be accessed for inspection purposes. Neither the code official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.~~))

R105.2 Required inspections. The *code official* or his or her designated agent, upon notification, shall make the inspections set forth in Sections R105.2.1 through R105.2.5.

R105.2.1 Footing and foundation inspection. Inspections associated with footings and foundations shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and approved plans and specifications.

R105.2.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation; fenestration properties (U-factor and SHCG) and proper installation; and air leakage controls as required by the code and approved plans and specifications.

R105.2.2.1 Wall insulation inspection. The *code official*, upon notification, shall make a wall insulation inspection in addition to those inspections required in Section R109 of the *International Residential Code*. This inspection shall be made after all wall and cavity insulation is in place and prior to cover.

R105.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and approved plans and specifications as to types of insulation and corresponding R-values and protection, and required controls.

R105.2.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verity compliance as required by the code and approved plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding R-value, system air leakage control, programmable thermostats, dampers, whole-house ventilation and minimum fan efficiency.

Exception: Systems serving multiple dwelling units shall be inspected in accordance with Section R105.2.4.

R105.2.5 Final inspection. The building shall have a final inspection and not be occupied until *approved*.

R105.3 Reinspection. A building shall be reinspected when determined necessary by the *code official*.

~~((**R105.4 Approved inspection agencies.** The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.))~~

R105.5 Inspection requests. It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

R105.6 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.

SECTION R106
NOTICE OF APPROVAL

~~((**R106.1 Approval.** After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official*.~~

~~**R106.2 Revocation.** The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.~~))

SECTION R107
VALIDITY

R107.1 General. If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code.

SECTION R108
REFERENCED STANDARDS

R108.1 Referenced codes and standards. The codes and standards referenced in this code shall be those listed in Chapter 5, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections R108.1.1 and R108.1.2.

R108.1.1 ((~~Conflicts~~)) <u>References to other codes</u>. ((~~Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.~~)) <u>Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, including local amendments. References to the "Residential Code," "Fire Code," "Electrical Code," "Mechanical Code" and "Plumbing Code" mean the Seattle editions of those codes.</u>

R108.1.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

R108.2 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

R108.3 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law. ((~~In addition to the requirements of this code, all occupancies shall conform to the provisions included in the state building code (chapter 19.27 RCW). In case of conflicts among codes enumerated in RCW 19.27.031(1) through (4) and this code, an earlier named code shall govern over those following.~~)) In the case of conflict between the duct sealing and insulation requirements of this code and the duct insulation requirements of Sections 603 and 604 of the *International Mechanical Code*, the duct insulation requirements of this code shall govern.

SECTION R109
((~~STOP WORK ORDER~~)) ENFORCEMENT

R109.1 Authority. ((~~Whenever the *code official* finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the *code official* is authorized to issue a stop work order.~~)) The *code official* is authorized to enforce this code in accordance with the International Residential Code, International Building Code, International Mechanical Code and Seattle Electrical Code.

((~~**R109.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property involved, the owner's authorized agent, or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work is authorized to resume.~~

~~**R109.3 Emergencies.** Where an emergency exists, the *code official* shall not be required to give a written notice prior to stopping the work.~~

~~**R109.4 Failure to comply.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject fines established by the authority having jurisdiction.~~))

SECTION R110
((~~MEANS OF APPEALS~~)) ADMINISTRATIVE REVIEW

((~~**R110.1 General.** In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.~~

~~**R110.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall have no authority to waive requirements of this code or interpret the administration of this code.~~

~~**R110.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.~~))

R110.1 Administrative review by the *code official*. Applicants may request administrative review by the *code official* of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the *code official*.

R110.2 Administrative review by the Construction Codes Advisory Board. Applicants may request review by the Construction Codes Advisory Board of decisions or actions pertaining to the application and interpretation of this code. The review will be performed by a panel of three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the *code official*.

R110.3 Reserved.

R110.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

SECTION R111
VIOLATIONS

It shall be unlawful for any person, firm, or corporation to erect or construct any building, or remodel or rehabilitate any existing building or structure in the state, or allow the same to be done, contrary to or in violation of any of the provisions of this code. Violations shall be administered according to the procedures set forth in Section 103 of the International Building Code or Section R103 of the International Residential Code, as applicable.

SECTION R112
LIABILITY

Nothing contained in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of any city or county or its officers, employees or agents for any injury or damage resulting from the failure of a building to conform to the provisions of this code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or approval authorized or issued or done in connection with the implementation or enforcement of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

This code shall not be construed to relieve or lessen the responsibility of any person owning, operating or controlling any building or structure for any damages to persons or property caused by defects, nor shall the Department of Construction and Inspections or The City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

CHAPTER 3 [RE]
GENERAL REQUIREMENTS

SECTION R301
CLIMATE ZONES

R301.1 General. Climate zones from Table R301.1 shall be used in determining the applicable requirements from Chapter 4.

TABLE R301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE AND COUNTY

Key: A – Moist, B – Dry, C – Marine. Absence of moisture designation indicates moisture regime is irrelevant.	
WASHINGTON	
5B Adams	4C Lewis
5B Asotin	5B Lincoln
5B Benton	4C Mason
5B Chelan	5B Okanogan
4C Clallam	4C Pacific
4C Clark	5B Pend Oreille
5B Columbia	4C Pierce
4C Cowlitz	4C San Juan
5B Douglas	4C Skagit
5B Ferry	5B Skamania
5B Franklin	4C Snohomish
5B Garfield	5B Spokane
5B Grant	5B Stevens
4C Grays Harbor	4C Thurston
4C Island	4C Wahkiakum
4C Jefferson	5B Walla Walla
4C King	4C Whatcom
4C Kitsap	5B Whitman
5B Kittitas	5B Yakima
5B Klickitat	

SECTION R302
DESIGN CONDITIONS

R302.1 Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

R302.2 Exterior design conditions. The heating or cooling outdoor design temperatures shall be selected from Appendix ((~~RC~~)) C.

SECTION R303
MATERIALS, SYSTEMS AND EQUIPMENT

R303.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

R303.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness,

The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical, or other permits are utilized for the project.

TABLE R406.3
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
1. EFFICIENT BUILDING ENVELOPE OPTIONS	Only one option from Items 1.1 through 1.4 may be selected in this category. Compliance with the conductive UA targets is demonstrated using Section R402.1.5, Total UA alternative, where [1-(Proposed UA/Target UA)] > the required %UA reduction		
1.1	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.22.	0.5	0.5
1.2	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.25 Floor R-38 Basement wall R-21 int plus R-5 ci Ceiling and single-rafter or joist-vaulted R-60 advanced Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab or Compliance based on Section R402.1.5: Reduce the Total conductive UA by 15%.	1.0	1.0
1.3	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Floor R-38 Basement wall R-21 int plus R-12 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab or Compliance based on Section R402.1.5: Reduce the Total conductive UA by 22.5%.	1.5	1.5
1.4	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Wood frame wall R-21 int plus R-16 ci Floor R-48 Basement wall R-21 int plus R-16 ci Slab on grade R-20 perimeter and under entire slab Below grade slab R-20 perimeter and under entire slab or Compliance based on Section R402.1.5: Reduce the Total conductive UA by 30%.	2.5	2.0
2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS	Only one option from Items 2.1 through 2.3 may be selected in this category.		
2.1	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft^2 maximum at 50 Pascals and All whole house ventilation requirements as determined by Section ((~~M1505.3~~)) M1505.4 of the *International Residential Code* or Section ((~~403.8~~)) 403.4.4 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.65. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	1.0	1.0

TABLE R406.3—continued
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
2.2	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.20 cfm/ft^2 maximum at 50 Pascals and All whole house ventilation requirements as determined by Section ((~~M1505.3~~)) M1505.4 of the *International Residential Code* or Section ((~~403.8~~)) 403.4.4 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.75. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	1.5	1.5
2.3	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.6 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.15 cfm/ft^2 maximum at 50 Pascals and All whole house ventilation requirements as determined by Section ((~~M1505.3~~)) M1505.4 of the *International Residential Code* or Section ((~~403.8~~)) 403.4.4 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.80. Duct installation shall comply with Section R403.3.2. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	2.0	2.0
3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS			
Only one option from Items 3.1 through 3.10 may be selected in this category. Item 3.11 may be taken with Items 3.1 or 3.3[c] only.			
3.1[a]	For a System Type 1 in Table R406.2: Energy Star rated (U.S. North) gas or propane furnace with minimum AFUE of 95%. or Energy Star rated (U.S. North) gas or propane boiler with minimum AFUE of 90% To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.0	1.0
3.2[a]	For secondary heating system serving System Type 2 in Table R406.2: Energy Star rated (U.S. North) Gas or propane furnace with minimum AFUE of 95% or Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	0.5
3.3[a,c,d]	Air-source centrally ducted heat pump with minimum HSPF2 of 8.1 (HSPF of 9.5). In areas where the winter design temperature as specified in Appendix RC is 23°F or below, a cold climate heat pump found on the NEEP cc ASHP qualified product list shall be used. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	N/A
3.4[a,d]	Closed-loop ground source heat pump; with a minimum COP of 3.3 or Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	1.0
3.5[d]	Ductless mini-split heat pump system, zonal control: In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF2 of 9 (HSPF of 10.0) shall be installed and provide heating to the largest zone of the housing unit. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	2.0

TABLE R406.3—continued
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
3.6[a,d]	Air-source, centrally ducted heat pump with minimum HSPF2 of 9.4 (HSPF of 11.0). A centrally ducted air source cold climate variable capacity heat pump (cc VCHP) found on the NEEP cc VCHP qualified product list with a minimum of 9 HSPF2 (10 HSPF) may be used to satisfy this requirement. In areas where the winter design temperature as specified in Appendix RC is 23°F or below, an air source centrally ducted heat pump shall be a cold climate variable capacity heat pump as listed on the NEEP qualified product list. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.0	N/A
3.7[a,d,e]	Ductless split system heat pumps with no electric resistance heating in the primary living areas. A ductless heat pump system with a minimum HSPF2 of 9 (HSPF of 10) shall be sized and installed to provide heat to entire dwelling unit at the design outdoor air temperature. **Exception:** In homes with total heating loads of 24,000 or less using multi-zone mini-split systems with nominal ratings of 24,000 or less, the minimum HSPF2 to claim this credit shall be 8.1 (9 HSPF). To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	2.0	3.0
3.8[a,d]	Air-to-water heat pump with minimum COP of 3.2 at 47°F, rated in accordance with AHRI 550/590 by an accredited or certified testing lab. To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	1.0	N/A
3.9	Gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15. For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units.	1.5	1.5
3.10[f]	Combination water heating and space heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. or For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0., shall serve all units. or For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	2.5	2.5
3.11[c]	Connected thermostat meeting ENERGY STAR Certified Smart Thermostats/EPA ENERGY STAR specifications. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the thermostat model.	0.5	0.5
4. HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM OPTIONS			
4.1	HVAC equipment and associated duct system(s) installation shall comply with the requirements of Section R403.3.2. Electric resistance heat, hydronic heating and ductless heat pumps are not permitted under this option. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.	0.5	N/A

TABLE R406.3—continued
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
5. EFFICIENT WATER HEATING OPTIONS Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.			
5.1	A drain water heat recovery unit(s) shall be installed, which captures wastewater heat from at least two showers, including tub/shower combinations. It is acceptable, but not required, for sink water to be connected. Unit shall have a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 54% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 or IAPMO IGC 346-2017 and be so labeled. To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it. Labels or other documentation shall be provided that demonstrates that the unit complies with the standard.	0.5	0.5
5.2	For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water between the nearest source of heated water and the termination of the fixture supply pipe where calculated using Section R403.5.2. *Construction documents* shall indicate the ounces of water in piping between the hot water source and the termination of the fixture supply. When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an On Demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater. To qualify for this credit, the dwelling must have a minimum of 1.5 bathrooms.	0.5	0.5
5.3	Water heating system shall include the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.80. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	0.5	0.5
5.4	Water heating system shall include one of the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.91. or Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems or Water heater heated by ground source heat pump meeting the requirements of Option 3.4. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	1.0	1.0
5.5	Water heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. or For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. shall supply domestic hot water to all units. or For R-2 Occupancy, gas-fired heat pump water heater(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply domestic hot water to all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	1.5	1.5
5.6	Water heating system shall include one of the following: Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification. or For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	2.0	2.5

TABLE R406.3—continued
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
5.7	Water heating system shall include one of the following: Electric heat pump water heater with a minimum UEF of 2.9 and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors. Equipment shall meet Section 4, requirements for all units, of the NEEA standard *Advanced Water Heating Specification* with the UEF noted above. or For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	2.5	3.0
5.8	Combination water heating and space heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. or For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0., shall supply all units. or For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	2.5	2.5
6. RENEWABLE ELECTRIC ENERGY OPTION			
6.1	For each 600 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 4.5 credits. Generation shall be calculated as follows: For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTs or approved alternative by the code official. Documentation noting solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors: The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.	0.5 – 4.5	0.5 – 4.5
7. APPLIANCE PACKAGE OPTION			
7.1	All of the following appliances shall be new and installed in the dwelling unit and shall meet the following standards: 1. Dishwasher, standard – Energy Star rated, Most Efficient 2021 or Dishwasher, compact – Energy Star rated (Version 6.0) 2. Refrigerator (if provided) – Energy Star rated (Version 5.1) 3. Washing machine (Residential) – Energy Star rated (Version 8.1) 4. Dryer – Energy Star rated, Most Efficient 2022 To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the appliance type and provide documentation of Energy Star compliance. At the time of inspection, all appliances shall be installed and connected to utilities. Dryer ducts and exterior dryer vent caps are not permitted to be installed in the *dwelling unit*.	0.5	1.5

a. An alternative heating source sized at a maximum of 0.5 Watts/ft^2 (equivalent) of heated floor area or 500 Watts, whichever is bigger, may be installed in the dwelling unit.

b. See Section R401.1 and *residential building* in Section R202 for Group R-2 scope.

c. Option 3.11 can only be taken with Options 3.1 and 3.3. To qualify to claim Option 3.11 with 3.3, the system shall be a 1-2 speed heat pump system. Variable capacity heat pumps are ineligible from claiming this option.

d. This option may only be claimed if serving System Type 4 or 5 from Table R406.2.

e. Primary living areas include living, dining, kitchen, family rooms, and similar areas.

f. Option 3.10 may only be taken with Efficient Water Heating Options 5.1 or 5.2. Equipment sizing for space heating shall be calculated as provided in Section R403.7 with increased capacity to provide a minimum of 75 percent of peak hot water demand or shall be sized in accordance with *approved* manufacturer's specifications or guidance. Supplementary heat for water heating system shall be in accordance with Section R403.5.7.

SECTION R407
CERTIFIED PASSIVE HOUSE

R407.1 General. Projects shall comply with Section R407.2 or R407.3.

R407.2 Passive House Institute U.S. (PHIUS). Projects shall comply with PHIUS+ 2018 Passive Building Standard, including its USDOE Energy Star and Zero Energy Ready Home co-requisites, and performance calculations by PHIUS-approved software. Projects shall also comply with the provisions of Table R405.2.

R407.2.1 PHIUS documentation. Prior to the issuance of a building permit, the following items must be provided to the *code official*:

1. A list of compliance features.
2. A PHIUS precertification letter.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:

1. A PHIUS+ 2018 (or later) project certificate.

R407.3 Passive House Institute (PHI). Projects shall comply with Low Energy Building Standard, version 9f or later, including performance calculations by PHI-approved software. Projects shall also comply with the provisions of Section R401 through R404.

R407.3.1 PHI documentation. Prior to the issuance of a building permit, the following items must be provided to the *code official*:

1. A list of compliance features.
2. A statement from a passive house certifier that the modeled energy performance is congruent with the plans and specifications, and that the modeled performance meets said standard.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:

1. A PHI Low Energy Building project certificate.

CHAPTER 5
EXISTING BUILDINGS

SECTION R501
GENERAL

R501.1 Scope. The provisions of this chapter shall control the *alteration*, *repair*, *addition* and change of occupancy of existing buildings and structures.

R501.1.1 General. Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code. Unaltered portions of the existing building or building supply system shall not be required to comply with this code.

R501.1.2 Thermostats for accessory dwelling units. Where a separate dwelling unit, that provides independent facilities for living, sleeping, cooking, bathing and sanitation, is established within or attached to an existing dwelling unit, the heating and cooling for the newly-created dwelling unit shall be controllable with a separate programmable thermostat in accordance with Section R403.1.1.

R501.2 Compliance. Additions, alterations, repairs or changes of occupancy to, or relocation of, an existing building, building system or portion thereof shall comply with Sections R502, R503, R504 or R505, respectively, in this code. Changes where unconditioned space is changed to conditioned space shall comply with Section R502.

R501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems that are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

R501.4 Compliance. *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in this code and the *International Residential Code*, *International Building Code*, *International Existing Building Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *Uniform Plumbing Code*, *International Property Maintenance Code*, and ((~~NFPA 70~~)) Seattle Electrical Code.

R501.5 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided hazards to life, health or property are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

R501.6 Historic buildings. The *code official* may modify the specific requirements of this code for historic buildings and require alternative provisions which will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings or structures that are listed in the state or national register of historic places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a national register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the national or state registers of historic places either individually or as a contributing building to a historic district by the state historic preservation officer or the keeper of the national register of historic places.

SECTION R502
ADDITIONS

R502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code, except as specified in this chapter. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition uses no more energy than the existing building. Additions shall be in accordance with Section R502.3 or R502.4.

R502.1.1 Small additions. *Additions* not greater than 150 square feet (13.9 m^2) shall not be required to comply with Section R406.

R502.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

Exception: Where the total building performance option in Section R405 is used to comply with this section, the annual energy use of the proposed design is permitted to be 110 percent of the annual energy use otherwise allowed by Section R405.3.

R502.3 Prescriptive compliance. Additions shall comply with Sections R502.3.1 through R502.3.4.

R502.3.1 Building envelope. New building envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.

Exception: Where nonconditioned space is changed to conditioned space, the building envelope of the addition shall comply where the UA, as determined in Section R402.1.5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to the UA generated for the existing building.

R502.3.1.1 Existing ceilings with attic spaces. Where an *addition* greater than 150 square feet (13.9 m^2) adjoins existing ceilings with attic spaces, the existing attic spaces shall comply with Section R402.

R502.3.2 Heating and cooling systems. HVAC ducts newly installed as part of an *addition* shall comply with Section R403.

Exception: The following need not comply with the testing requirements of Section R403.3.3:

1. *Additions* of less than 150 square feet.
2. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in WSU RS-33.
3. Existing duct systems constructed, insulated or sealed with asbestos.

R502.3.3 Service hot water systems. New service hot water systems that are part of the *addition* shall comply with Section R403.5.

R502.3.4 Lighting. New lighting systems that are part of the *addition* shall comply with Section 404.1.

R502.4 Existing plus addition compliance (Total Building Performance). Where nonconditioned space is changed to conditioned space the addition shall comply where the annual energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy use of the existing building when modeled in accordance with Section R405. The addition and any alterations that are part of the project shall comply with Section R405 in its entirety.

SDCI Informative Note: *Alterations* to existing buildings typically do not require R406 Energy Credits. However, Section R406.3 does require energy credits for *additions* larger than 500 square feet, and the Chapter 2 definition of "addition" includes any space, such as a garage or unheated basement, that is converted from unheated to heated space. Therefore, if an ADU (accessory dwelling unit) is created within existing heated space in a dwelling unit, it does not require energy credits. However, if creation of the ADU converts any unheated space to heated space, then all code requirements for additions apply, and if the space converted from unheated to heated is larger than 500 square feet, the R406.3 requirements for energy credits must also be met.

SECTION R503
ALTERATIONS

SDCI Informative Note: For landmark buildings, see Section R101.6.

R503.1 General. *Alterations* to any building or structure shall comply with the requirements of the code for new construction, without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*.

Alterations shall not create an unsafe or hazardous condition or overload existing building systems. *Alterations* shall be such that the existing building or structure uses no more energy than the existing building or structure prior to the *alteration*. Alterations to existing buildings shall comply with Section R503.1.1 through R503.1.4.

The *code official* may approve designs of alterations which do not fully conform to all of the requirements of this code where in the opinion of the *code official* full compliance is physically impossible and/or economically impractical and:

1. The alteration improves the energy efficiency of the building; or
2. The alteration is energy efficient and is necessary for the health, safety, and welfare of the general public.

R503.1.1 Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.3 or R402.1.5, Sections R402.2.1 through R402.2.10, R402.3.1, R402.3.2, R402.3.5, and R402.4.2.

CHAPTER 1
SCOPE AND ADMINISTRATION

Note: Chapter 1 is entirely Seattle amendments to the *International Existing Building Code* and is not underlined.

SECTION 101
SCOPE AND APPLICATION OF CODE

101.1 Title. This subtitle shall be known as the "International Existing Building Code." All references to the *International Existing Building Code* contained in this code mean the *Seattle Existing Building Code*.

101.2 Scope. This code applies to the *repair*, *alteration*, *change of occupancy*, *addition* to, relocation and maintenance of *existing buildings*.

Exception: Buildings within the scope of the *International Residential Code* shall comply with the *International Residential Code*.

101.3 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, occupancy, location and maintenance of certain *existing buildings* and structures within the City and certain equipment in those buildings, as specifically regulated herein. The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

101.4 Compliance. Except as specifically provided in this code, *additions*, *alterations*, *repairs* and *changes of occupancy* to, and relocation of any *building* or structure shall comply with the requirements of the code for new construction. Except as specifically provided in this code, *additions*, *alterations*, *repairs* and *changes of occupancy* to, and relocation of any *building* or structure shall be such that the *existing building* or structure is no less complying with the provisions of the *International Building Code* than the *existing building* or structure was prior to the *alteration*, *addition*, *repair*, *change of occupancy* or relocation.

101.4.1 Unless approved by the *code official*, this code does not justify conditions in buildings or structures that do not comply with the codes in effect at the time the building or structure was built, including permitted *additions*, *alterations*, *repairs*, *changes of occupancy* and relocations.

101.4.2 Buildings not previously occupied. A building or portion of a building that has not been previously occupied or used for its intended purpose in accordance with the laws in existence at the time of its completion shall comply with the provisions of the *International Building Code* for new construction or with any current permit for such occupancy.

101.4.3 Buildings previously occupied. Buildings in existence at the time of the passage of this code that were legally constructed and occupied in accordance with the provisions of a prior code are permitted to have their existing occupancy continued, provided such occupancy is not unsafe.

101.4.3.1 Establishing occupancy for the record. An occupancy is permitted to be established for any date if:

1. The applicant can provide evidence satisfactory to the code official that the occupancy was in existence on that date, and
2. The building can be made to comply with the building code in effect on that date.

101.4.4 Compliance with retroactive ordinances. *Alterations* and *repairs* to *existing buildings* that are being made in response to a notice or order requiring compliance with the *Housing and Building Maintenance Code*, Subtitle II, Title 22 of the Seattle Municipal Code, the *Fire Code*, Subtitle VI, Title 22 of the Seattle Municipal Code, or other ordinances applicable to *existing buildings*, are permitted to be made in accordance with standards contained in those ordinances rather than the standards contained in this code.

101.5 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and safeguards which are or were required by a code in effect when the building or structure was erected, altered or repaired shall be maintained in conformance with the code edition under which they were installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. To determine compliance with this subsection, the code official shall have the authority to require a building or structure to be reinspected. The requirements of this Chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in *existing buildings* or structures.

Exception: The code official is authorized to modify the requirements of this subsection where all or a portion of a building is unoccupied, closed off and reasonably secure from unlawful entry.

101.6 Internal Consistency. If in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. If there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

101.7 Referenced codes and standards. The codes and standards referenced in this code are considered part of the requirements of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply.

101.8 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, including local amendments. References to the "Building Code," "Residential Code," "Fire Code," "Mechanical Code" and "Plumbing Code" mean the Seattle editions of those codes.

101.9 Appendices. Provisions in the appendices of the *International Existing Building Code* do not apply, with the exception of Chapters A1 and A3 through A6 of Appendix A, which are herein adopted.

101.10 Metric units. Wherever in this code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

101.11 Impracticality. In cases where total compliance with all the requirements of this code is impractical, the applicant may arrange a pre-design conference with the design team and the code official. The applicant shall identify design solutions and modifications that conform to Section 101.12 or 101.13. The code official may waive specific requirements in this code that the code official determines to be impractical.

101.12 Modifications. The code official may modify the requirements of this code for individual cases if the code official finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of fire protection and structural integrity when considered together with other safety features of the building or other relevant circumstances. The code official may, but is not required to, record the approval of modifications and any relevant information in the files of the code official or on the approved permit plans.

101.13 Alternate materials, methods of construction and design. This code does not prevent the use of any material, design or method of construction not specifically allowed or prohibited by this code, provided the alternate has been approved and its use authorized by the code official.

The code official may approve an alternate, provided the code official finds that the proposed alternate complies with the provisions of this code, and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation.

The code official may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The code official may, but is not required to, record the approval of code alternates and any relevant information in the files of the code official or on the construction documents.

101.14 Unsafe conditions. The code official shall have the authority to require the elimination of conditions deemed *unsafe* in accordance with *International Building Code* Section 102.

SECTION 102
ADMINISTRATION

102.1 General. *Additions*, *alterations*, *repairs* and *changes of occupancy* to and relocations of buildings and structures are subject to Chapter 1 of the *Seattle Building Code*.

CHAPTER 2
DEFINITIONS

User note:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.*

SECTION 201
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the other International Codes, such terms shall have the meanings ascribed to them in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this chapter, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202
GENERAL DEFINITIONS

[A] ADDITION. An extension or increase in floor area, number of stories, or height of a building or structure.

[W] ADULT FAMILY HOME. A *dwelling*, licensed by the State of Washington Department of Social and Health Services, in which a person or persons provide personal care, special care, room and board to more than one but not more than six adults who are not related by blood or marriage to the person or persons providing the services. An existing adult family home may provide services to up to eight adults upon approval from the Department of Social and Health Services in accordance with RCW 70.128.066.

[A] ALTERATION. Any construction or renovation to an *existing structure* other than a *repair* or *addition*.

[A] APPROVED. Acceptable to the *code official*.

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any occupancy.

[S][A] CHANGE OF OCCUPANCY. ((~~Any of the following shall be considered as a change of occupancy where the current *International Building Code* requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:~~)) A change in the use of a building or a portion of a building that results in any of the following:

1. Any change in the occupancy classification. ((~~of a building or structure.~~))
2. Any change ((~~in the purpose of, or a change in the level of activity within, a building or structure~~)) from one group to another group within an occupancy classification.
3. A change of use within a group for which there is a change in application of the requirements of this code.

[S] ((~~[A] CHANGE OF USE.~~ ~~A change in the use of a building or a portion of a building, within the same group classification, for which there is a change in application of the code requirements.~~))

[S][A] CODE OFFICIAL. The ((~~officer or other designated authority charged with the administration and enforcement of this code~~)) Director of the Department of Construction and Inspections and authorized representatives.

[S] DAMAGE RATIO. The ratio between the cost of work and the estimated replacement cost of the building, expressed as a percentage.

[S] ((~~[BS] DANGEROUS.~~ ~~Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:~~

1. ~~The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.~~

~~2. There exists a significant risk of collapse, detachment or dislodgement of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake or other environmental loads when such loads are imminent.~~))

[A] DEFERRED SUBMITTAL. Those portions of the design that are not submitted at the time of the application and that are to be submitted to the *code official* within a specified period.

[S] ((~~[BS] DISPROPORTIONATE EARTHQUAKE DAMAGE.~~ ~~A condition of earthquake-related damage where both of the following occur:~~

~~1. The 0.3-second spectral acceleration at the building site as estimated by the United States Geological Survey for the earthquake in question is less than 40 percent of the mapped acceleration parameter SS.~~

~~2. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 10 percent from its predamage condition.~~))

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

EQUIPMENT OR FIXTURE. Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection equipment; and elevators, dumbwaiters, escalators, boilers, pressure vessels and other mechanical facilities; or installations that are related to building services. Equipment or fixture shall not include manufacturing, production or process equipment, but shall include connections from building service to process equipment.

[S][A] EXISTING BUILDING, EXISTING STRUCTURE. A building or structure erected prior to the date of adoption of ((~~the appropriate~~)) this code, or one for which a ((~~legal building permit~~)) valid Certificate of Occupancy has been issued, or one that has passed a final inspection.

[S] ((~~[A] EXISTING STRUCTURE.~~ ~~A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.~~))

[BF] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments, such as cornices, soffits, facias, gutters and leaders.

[BF] EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space from the detrimental effects of the exterior environment.

[A] FACILITY. All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site.

[BS] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year.
2. The area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated.

[S] ((~~[A] HISTORIC BUILDING.~~ ~~Any building or structure that is one or more of the following:~~

~~1. Listed, or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.~~

~~2. Designated as historic under an applicable state or local law.~~

~~3. Certified as a contributing resource within a National Register, state designated or locally designated historic district.~~))

[S] LANDMARK. A building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

[S] LIFE SAFETY PERFORMANCE LEVEL. A post-earthquake damage state that includes damage to structural elements, but the building retains a margin against partial or total collapse. Injuries may occur, but the overall risk of life-threatening injury as a result of structural damage is expected to be low.

[BF] NONCOMBUSTIBLE MATERIAL. A material that, under the conditions anticipated, will not ignite or burn when subjected to fire or heat. Materials that pass ASTM E136 are considered *noncombustible materials*.

PRIMARY FUNCTION. A *primary function* is a major activity for which the *facility* is intended. Areas that contain a *primary function* include, but are not limited to, the customer services lobby of a bank, the dining area of a cafeteria, the meeting rooms in a conference center, as well as offices and other work areas in which the activities of the public accommodation or other private entity using the *facility* are carried out. Mechanical rooms, boiler rooms, supply storage rooms, employee lounges or locker rooms, janitorial closets, entrances, corridors and restrooms are not areas containing a *primary function*.

[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A registered design professional engaged by the owner or the owner's authorized agent to review and coordinate certain aspects of the project, as determined by the *code official*, for compatibility with the design of the building or structure, including submittal documents prepared by others, *deferred submittal* documents and phased submittal documents.

REHABILITATION. Any work, as described by the categories of work defined herein, undertaken in an *existing building.*

[A] RELOCATABLE BUILDING. A partially or completely assembled building constructed and designed to be reused multiple times and transported to different building sites.

[A] REPAIR. The reconstruction, replacement or renewal of any part of an *existing building* for the purpose of its maintenance or to correct damage.

[BS] REROOFING. The process of recovering or replacing an existing roof covering. See "*Roof recover*" and "*Roof replacement*."

[S] RETROFITTED UNREINFORCED MASONRY (URM) BUILDING. A *URM building* that meets a minimally acceptable level of life safety risk from earthquakes by demonstrating compliance with Section 304.5.1.

Note: *Retrofitted URM buildings* are eligible for a status change in the City of Seattle URM database.

[BS] RISK CATEGORY. A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance, as provided in Section 1604.5 of the *International Building Code*.

[BS] ROOF COATING. A fluid-applied adhered coating used for roof maintenance, *roof repair* or as a component of a roof covering system or roof assembly.

[BS] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[BS] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of correcting damage or restoring the predamage condition.

[BS] ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

[BS] SEISMIC FORCES. The loads, forces and requirements prescribed herein, related to the response of the building to earthquake motions, to be used in the analysis and design of the structure and its components. Seismic forces are considered either full or reduced, as provided in Chapter 3.

[S] SUBSTANTIAL ALTERATION. See Section 311.1.

[BS] SUBSTANTIAL DAMAGE. For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[S][BS] SUBSTANTIAL IMPROVEMENT. ((~~For the purpose of determining compliance with the flood provisions of this code, any~~)) Any *repair*, *alteration*, *addition* or improvement of a building or structure, the cost of which, in any five-year period, equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage*, any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a ((~~historic~~)) *landmark* structure, provided that the *alteration* will not preclude the structure's continued designation as a ((~~historic~~)) *landmark* structure.

[S] ((~~[BS] SUBSTANTIAL STRUCTURAL ALTERATION.~~ ~~An *alteration* in which the gravity load-carrying structural elements altered within a 5-year period support more than 30 percent of the total floor and roof area of the building or structure. The areas to be counted toward the 30 percent shall include mezzanines, penthouses, and in-filled courts and shafts tributary to the altered structural elements.~~))

[S] ((~~[BS] SUBSTANTIAL STRUCTURAL DAMAGE.~~ ~~A condition where any of the following apply:~~

~~1. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 33 percent from its predamage condition.~~

~~2. The capacity of any vertical component carrying gravity load, or any group of such components, that has a tributary area more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its predamage condition, and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~3. The capacity of any structural component carrying snow load, or any group of such components, that supports more than 30 percent of the roof area of similar construction has been reduced more than 20 percent from its predamage condition, and the remaining capacity with respect to dead, live and snow loads is less than 75 percent of that required by the *International Building Code* for new buildings of similar structure, purpose and location.~~))

TECHNICALLY INFEASIBLE. An *alteration* of a *facility* that has little likelihood of being accomplished because the existing structural conditions require the removal or *alteration* of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces or features which are in full and strict compliance with the minimum requirements for new construction and which are necessary to provide accessibility.

[S] UNSAFE. ((~~Buildings, structures or equipment that are unsanitary, or that are deficient due to inadequate means of egress *facilities*, inadequate light and ventilation, or that constitute a fire hazard, or in which the structure or individual structural members meet the definition of *"Dangerous,"* or that are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance shall be deemed *unsafe*. A vacant structure that is not secured against entry shall be deemed *unsafe*.~~)) Structurally unsound, provided with inadequate egress, constituting a fire hazard, or otherwise dangerous to human life, or constituting a hazard to safety, health or public welfare.

[S] UNREINFORCED MASONRY (URM). Includes burned clay, concrete or sand-lime brick, hollow clay block, or hollow clay tile.

[S] UNREINFORCED MASONRY (URM) BUILDING. A building where one or more *URM* walls provide the primary support for vertical loads from floors or roofs and the *URM* walls rely on the tensile strength of masonry units, mortar and grout in resisting design loads.

Note: *URM buildings* were generally constructed prior to 1945 and unlawful after adoption of the 1973 Uniform Building Code on May 7, 1977.

[S] WORK AREA. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code. The boundary of the work area includes all spaces not physically separated from rooms or spaces where work is being performed.

CHAPTER 3
PROVISIONS FOR ALL COMPLIANCE METHODS

User note:

About this chapter: *Chapter 3 explains the three compliance options for alterations and additions available in the code. In addition, this chapter also lays out the methods to be used for seismic design and evaluation throughout this code. Finally, this chapter clarifies that provisions in other I-Codes® related to repairs, alterations, additions, relocation and changes of occupancy must also be addressed unless they conflict with this code. In that case, this code takes precedence.*

SECTION 301
((~~ADMINISTRATION~~)) COMPLIANCE METHODS

[S] 301.1 Applicability. All *repairs*, *alterations*, *changes of occupancy*, *additions* and relocations of buildings shall comply with this chapter. The ((~~*repair*~~,)) *alteration*, *change of occupancy*, *addition* or relocation of all *existing buildings* and structures shall also comply with Section 301.2, 301.3 or 301.4. ((~~The provisions of Sections 302 through 309 shall apply to all *alterations*, *repairs*, *additions*, relocation of structures and *changes of occupancy* regardless of compliance method.~~))

301.1.1 Bleachers, grandstands and folding and telescopic seating. Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

301.2 Repairs. *Repairs* shall comply with the requirements of Chapter 4.

[S] 301.3 Alteration, addition or change of occupancy. The *alteration*, *addition* or *change of occupancy* of all *existing buildings* and structures shall also comply with one of the methods listed in Section 301.3.1, 301.3.2 or 301.3.3 as selected by the applicant. Sections 301.3.1 through 301.3.3 shall not be applied in combination with each other.

Exception: Subject to the approval of the *code official*, *alterations* ((~~complying~~)) that comply with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building is undergoing a *substantial alteration*. New structural members added as part of the *alteration* shall comply with the *International Building Code*. This exception shall not apply to the following:

1. *Alterations* for accessibility required by Section 306.
2. *Alterations* that constitute *substantial improvement* in *flood hazard areas*, which shall comply with ((~~Sections 503.2, 701.3 or 1301.3.3~~)) Section 314.

((~~3. Structural provisions of Section 304, Chapter 5 or to the structural provisions of Sections 706, 805 and 906.~~))

301.3.1 Prescriptive compliance method. *Alterations*, *additions* and *changes of occupancy* complying with Chapter 5 of this code in buildings complying with the *International Fire Code* shall be considered in compliance with the provisions of this code.

301.3.2 Work area compliance method. *Alterations*, *additions* and *changes of occupancy* complying with the applicable requirements of Chapters 6 through 12 of this code shall be considered in compliance with the provisions of this code.

301.3.3 Performance compliance method. *Alterations*, *additions* and *changes of occupancy* complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

[S] 301.4 Relocated buildings. Relocated buildings shall comply with the requirements of ((~~Chapter 14~~)) Section 313.

[S] SECTION 302
((~~GENERAL PROVISIONS~~))
ADDITIONAL REQUIREMENTS FOR ALL COMPLIANCE METHODS

[S] 302.1 ((~~Dangerous conditions~~)) Reserved. ((~~The *code official* shall have the authority to require the elimination of conditions deemed *dangerous*.~~))

[S] 302.2 Additional codes. ((~~*Alterations*~~)) Regardless of the compliance method, *alterations*, *repairs*, *additions* and *changes of occupancy* to, or relocation of, *existing buildings* and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and *changes of occupancy* or relocation, respectively, in this code and the *International Energy Conservation Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, ((~~*International*~~)) *Uniform Plumbing Code*, ((~~*International Private Sewage Disposal Code*, *International Property Maintenance Code*, *International Residential Code*~~)) *Seattle Boiler and Pressure Vessel Code*, *Seattle Electrical Code* and NFPA 70. Elevators and other conveyances shall

comply with the *International Building Code*. Where provisions of the other codes conflict with provisions of this code, the provisions of this code shall take precedence.

Note: Additional requirements relating to elevators and other conveyances are in the Seattle Building Code. Most requirements are located in Chapter 30.

302.2.1 Additional codes in health care. In existing Group I-2 occupancies, ambulatory health care *facilities*, outpatient clinics and hyperbaric *facilities*, *alterations*, *repairs*, *additions* and *changes of occupancy* to, or relocation of, *existing buildings* and structures shall also comply with NFPA 99.

[S] 302.2.2 Fire prevention. Except as specifically provided for in this code, the provisions of the *International Fire Code* shall apply to matters affecting or relating to structures, processes and premises regarding:

1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices;
2. Conditions hazardous to life, property or public welfare in the occupancy of structures or premises; and
3. The construction, extension, *repair*, *alteration* or removal of fire suppression and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.

[S] 302.3 Existing materials. Materials already in use in a building ((~~in compliance~~)) complying with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless ((~~determined~~)) the materials are deemed unsafe by the code official. ((~~to be *unsafe*.~~))

302.4 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs* and *alterations*, provided that *unsafe* conditions are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

[BS] 302.4.1 New structural members and connections. New structural members and connections shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

Exception: Where alternative design criteria are specifically permitted.

302.5 Occupancy and use. Where determining the appropriate application of the referenced sections of this code, the occupancy and use of a building shall be determined in accordance with Chapter 3 of the *International Building Code*.

[S] 302.6 Safeguards during construction. Regardless of compliance method, *alterations*, repairs, *additions* and *changes of occupancy* to, or relocation of, *existing buildings* and structures shall comply with the provisions of Chapter 15.

[S] 302.7 Occupant load increases in Group A occupancies. Regardless of which compliance method is used, when the occupant load in an existing Group A occupancy is increased, an automatic sprinkler system shall be installed in the fire area containing the Group A occupancy if a sprinkler system would be required by *International Building Code* Section 903.2.1 for new construction.

Exception: A sprinkler system is not required if all the following conditions are met:

1. The increase in occupant load is either 50 occupants or less, or no more than 10 percent of the occupant load of the existing Group A occupancy, whichever is greater; and
2. The existing means of egress has adequate capacity to accommodate the additional occupant load; and
3. The total occupant load in the Group A occupancy does not exceed one occupant per 5 square feet; and
4. The increase in occupant load is not part of a *substantial alteration*.

[S] 302.8 Unsafe building appendages. Parapet walls, cornices, spires, towers, tanks, statuary and other appendages or structural members that are supported by, attached to, or a part of a building and that are in a deteriorated condition or are otherwise unable to sustain the design loads that are specified in this code, are hereby designated as *unsafe* building appendages. All such *unsafe* building appendages are public nuisances and shall be abated in accordance with Section 101.14.

[S] 302.9 Unreinforced masonry chimneys. Whenever an unreinforced masonry chimney is altered or *repaired*, or when the building in which such a chimney is located undergoes *substantial alteration*, the chimney shall conform to rules promulgated by the code official.

[S] ((~~SECTION 303 STORM SHELTERS~~

~~**303.1 Storm shelters.** This section applies to the construction of storm shelters constructed as rooms or spaces within *existing buildings* for the purpose of providing protection during storms that produce high winds, such as tornados and hurricanes. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Such structures shall be constructed in accordance with this code and ICC 500.~~

~~**303.2 Addition to a Group E occupancy.** Where an *addition* is added to an existing Group E occupancy located in an area where the shelter design wind speed for tornados is 250 mph (402.3 km/h) in accordance with Figure 304.2(1) of ICC 500 and the occupant load in the *addition* is 50 or more, the *addition* shall have a storm shelter constructed in accordance with ICC 500.~~ **

~~**Exceptions:**~~

~~1. Group E day care *facilities*.~~

~~2. Group E occupancies accessory to places of religious worship.~~

~~3. *Additions* meeting the requirements for shelter design in ICC 500.~~

~~**303.2.1 Required occupant capacity.** The required occupant capacity of the storm shelter shall include all buildings on the site, and shall be the total occupant load of the classrooms, vocational rooms and offices in the Group E occupancy.~~

~~**Exceptions:**~~

~~1. Where an *addition* is being added on an existing Group E site, and where the *addition* is not of sufficient size to accommodate the required occupant capacity of the storm shelter for all of the buildings on-site, the storm shelter shall at a minimum accommodate the required capacity for the *addition*.~~

~~2. Where *approved* by the *code official*, the required occupant capacity of the shelter shall be permitted to be reduced by the occupant capacity of any existing storm shelters on the site.~~

~~**303.2.2 Occupancy classification.** The occupancy classification for storm shelters shall be determined in accordance with Section 423.3 of the *International Building Code*.~~))

[S] SECTION 304
STRUCTURAL ((~~DESIGN LOADS AND EVALUATION AND DESIGN PROCEDURES~~)) REQUIREMENTS FOR ALL COMPLIANCE METHODS

[S] 304.1 Structural provisions for alterations. Alterations to any building or structure shall comply with the requirements of Sections 304.1.1 through 304.1.8.

[BS] 304.1.1 New structural elements. New structural elements in alterations, including connections and anchorage, shall comply with the International Building Code.

[BS] 304.1.2 Minimum design loads. The minimum design loads on existing elements of a structure that do not support additional loads as a result of an *alteration* shall be the loads applicable at the time the building was constructed.

[BS] 304.1.3 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design ((~~dead, live or snow~~)) gravity load ((~~, including snow drift effects,~~)) of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity ((~~loads~~)) load required by the *International Building Code* for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the *alteration* shall be shown to have the capacity to resist the applicable design ((~~dead, live and snow~~)) gravity loads ((~~including snow drift effects~~)) required by the *International Building Code* for new structures. **

((~~Exceptions~~)) Exception: ((~~1.~~)) Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the ((~~altered~~)) existing building and its alteration ((~~complies~~)) comply with the conventional light-frame construction methods of the *International Building Code*, ((~~or the provisions of the *International Residential Code*.~~

~~2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing single layer of roof covering.~~))

[BS] ((~~304.1~~)) 304.1.3.1 Live loads. Where an *addition* or *alteration* does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads *approved* prior to the *addition* or *alteration*. If the *approved* live load is less than that required by Section 1607 of the *International Building Code*, the area designated for the nonconforming live load shall be posted with placards of *approved* design indicating the *approved* live load. Where the *addition* or *alteration* results in increased design live load, the live load required by Section 1607 of the *International Building Code* shall be used.

[BS] 304.1.4 Existing structural elements carrying lateral load. ((~~Except as permitted by Section 503.13, where~~)) Where the *alteration* increases design lateral loads in accordance with Section 1609 or 1613 of the *International Building Code*, or where the *alteration* results in a prohibited structural irregularity as defined in ASCE 7, or where the *alteration* decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall be shown to meet the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced *International Building Code*-level seismic forces in accordance with Section 304.4.2 shall be permitted. **

Exception: Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *International Building Code*. Reduced *International Building Code*–level seismic forces in accordance with Section 304.4.2 shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.

** **[BS] 304.1.5 ((~~Anchorage~~)) Wall anchorage for unreinforced masonry walls in major alterations.** Where the ((~~*work area*~~)) portion of the building undergoing the intended *alteration* exceeds 50 percent of the aggregate area of the building, ((~~area,~~)) the building is assigned to Seismic Design Category C, D, E or F, and the building's structural system includes unreinforced masonry ((~~bearing~~)) walls, the *alteration* work shall include installation of wall anchors at the ((~~floor and~~)) roof ((~~lines~~)) line to resist seismic forces, unless an evaluation demonstrates compliance of existing wall anchorage. ((~~Reduced~~)) For purposes of this section, reduced design seismic forces shall be permitted.

** **[BS] 304.1.6 Anchorage of unreinforced masonry partitions in major alterations.** Where the *work area* exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category C, D, E or F, unreinforced masonry partitions and nonstructural walls within the *work area* and adjacent to egress paths from the *work area* shall be anchored, removed or altered to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Use of reduced seismic forces shall be permitted.

** **[W][S][BS] 304.1.7 Voluntary ((~~lateral force-resisting system alterations~~)) seismic improvements.** ((~~Structural *alterations*~~)) *Alterations* to existing structural elements or *additions* of new structural elements that are ((~~intended exclusively to improve the lateral force-resisting system and are~~)) not otherwise required by ((~~other sections of this code~~)) this chapter and are initiated for the purpose of improving the performance of the seismic force-resisting system of an existing structure or the performance of seismic bracing or anchorage of existing nonstructural elements ((~~shall not be required to meet the requirements of Section 1609 or Section 1613 of the *International Building Code*, provided that all of the following apply~~)) shall be permitted, if an engineering analysis is submitted demonstrating the following:

((~~1. The capacity of existing structural systems to resist forces is not reduced.~~))

1. The altered structure and the altered nonstructural elements are no less conforming to the provisions of the *International Building Code* with respect to earthquake design than they were prior to the *alteration*.

   Exception: Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is no more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces per Sections 1609 and 1613 of the *International Building Code*. For purposes of this exception, comparisons of demand capacity ratios and calculation of design lateral loads, forces, and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.

2. New structural elements are detailed and connected to existing or new structural elements as required by the ((~~*International Building Code* for new construction~~)) selected design criteria.

   2.1. Where approved, the new lateral force-resisting systems are permitted to be of a type designated as "Ordinary" or "Intermediate" where ASCE 7 Table 12.2-1 states these types of systems are not permitted provided that both of the following apply:

      2.1.1. The selected design criteria is the *International Building Code*.

      2.1.2. The new "Ordinary" or "Intermediate" system provides deformation compatibility with the existing lateral force-resisting system.

3. New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required ((~~by the *International Building Code*~~)) for new construction.

4. The *alterations* do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

((~~**[BS] 304.2 Snow loads on adjacent buildings.** Where an *alteration* or *addition* changes the potential snow drift effects on an adjacent building, the *code official* is authorized to enforce Section 7.12 of ASCE 7.~~))

** **[S] 304.2 ((~~Seismic loads (seismic force-resisting system)~~)) Structural provisions for changes of occupancy.** Where a *change of occupancy* results in a ((~~building~~)) structure being ((~~assigned~~)) reclassified to a higher *risk category* determined in accordance with Table 1604.5 of the *International Building Code*, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the ((~~building~~)) structure shall ((~~satisfy~~)) conform to the seismic requirements for a new structure of the higher risk category. For purposes of this section, compliance with ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table 304.4.1 for the applicable risk category, shall be deemed to meet requirements of Section 1613 of the *International Building Code*. ((~~for the new *risk category* using full seismic forces.~~))

((~~**Exceptions:**~~

1. ~~Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to *Risk Category* IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.~~
2. ~~Where a *change of use* results in a building being reclassified from *Risk Category* I or II to Risk Category III and the seismic coefficient, S_{DS}, is less than 0.33, compliance with this section is not required.~~
3. ~~Unreinforced masonry bearing wall buildings assigned to *Risk Category* III and to Seismic Design Category A or B, shall be permitted to use Appendix Chapter A1 of this code.~~
4. ~~Where the change is from a Group S or Group U occupancy and there is no change of risk category, use of reduced seismic forces shall be permitted.~~))

Exception: Specific seismic detailing requirements of Section 1613 of the *International Building Code* for a new structure shall not be required to be met where the seismic performance is shown to be equivalent to that of a new structure. A demonstration of equivalence shall consider the regularity, overstrength, redundancy and ductility of the structure.

[S] 304.3 Structural provisions for additions. *Additions* to any building or structure shall comply with the requirements of Sections 304.3.1 through 304.3.3.

[S][BS] 304.3.1 New structural elements. New structural elements in additions, including connections and anchorage, shall comply with the International Building Code.

[BS] 304.3.2 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an *addition* and its related *alterations* cause an increase in design ((~~dead, live or snow~~)) gravity load ((~~, including snow drift effects,~~)) of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity ((~~loads~~)) load required by the *International Building Code* for new structures. Any existing gravity load-carrying structural element whose ((~~vertical~~)) gravity load-carrying capacity is decreased ((~~as part of the *addition* and its related *alterations*~~)) shall be considered ((~~to be~~)) an altered element subject to the requirements of Section ((~~503.3~~)) 304.1.3. Any existing element that will form part of the lateral load path for any part of the *addition* shall be considered ((~~to be~~)) an existing lateral load-carrying structural element subject to the requirements of Section ((~~502.5~~)) 304.3.3. **

((~~**Exception:** Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the *addition* together comply with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.~~))

[BS] 304.3.2.1 Design live load. Where the *addition* does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads *approved* prior to the *addition*. If the *approved* live load is less than that required by Section 1607 of the *International Building Code*, the area designed for the nonconforming live load shall be posted with placards of *approved* design indicating the *approved* live load. Where the *addition* does result in increased design live load, the live load required by Section 1607 of the *International Building Code* shall be used.

[BS] 304.3.3 Existing structural elements carrying lateral load. Where the *addition* is structurally independent of the *existing structure,* existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the *addition* is not structurally independent of the *existing structure,* the *existing structure* and its *addition* acting together as a single structure shall be shown to meet the requirements of Sections 1609 and 1613 of the *International Building Code*. ((~~using full seismic forces.~~)) For purposes of this section, compliance with ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table 304.4.1 for the applicable risk category, shall be deemed to meet the requirements of Section 1613 of the *International Building Code*. **

((~~**Exceptions**~~)) **Exception:** ((~~1.~~)) Any existing lateral load-carrying structural element whose demand-capacity ratio with the *addition* considered is not more than 10 percent greater than its demand-capacity ratio with the *addition* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *International Building Code*. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.

((~~2. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the addition together comply with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.~~))

[S][BS] ((~~304.3~~)) 304.4 Seismic evaluation and design procedures. Where required, seismic evaluation or design shall be based on the procedures and criteria ((~~in this section, regardless of which compliance method is used~~)) specified in the *International Building Code* or ASCE 41. The procedures contained in Appendix A of this code shall be permitted to be used as specified in Section 304.4.2.

[BS] ((~~304.3.1~~)) 304.4.1 Compliance with ((~~full~~)) International Building Code–level seismic forces. Where compliance ((~~requires the use of full seismic forces~~)) with the seismic design provisions of the International Building Code is required, the criteria shall be in accordance with one of the following:

1. One-hundred percent of the values in the *International Building Code*. Where the existing seismic force-resisting system is a type that can be designated as "Ordinary," values of R, Ω_0 and C_d used for analysis in accordance with Chapter 16 of the *International Building Code* shall be those specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system will provide performance equivalent to that of a "Detailed," "Intermediate" or "Special" system.
2. ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table ((~~304.3.1~~)) 304.4.1 for the applicable *risk category*.

[BS] TABLE ((~~304.3.1~~)) 304.4.1
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH ((~~FULL~~)) INTERNATIONAL BUILDING CODE–LEVEL SEISMIC FORCES

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1N EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2N EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3)	Collapse Prevention (S-5)
II	Life Safety (S-3)	Collapse Prevention (S-5)
III	Damage Control (S-2)	Limited Safety (S-4)
IV	Immediate Occupancy (S-1)	Life Safety (S-3)

[BS] ((~~304.3.2~~)) 304.4.2 Compliance with reduced International Building Code seismic forces. Where seismic evaluation and design is permitted to use reduced seismic forces, the criteria used shall be in accordance with one of the following:

1. The *International Building Code* using 75 percent of the prescribed forces. Values of R, Ω_0 and C_d used for analysis shall be as specified in Section ((~~304.3.1~~)) 304.4.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.4 and subject to the limitations of the respective Appendix A chapters shall be deemed to comply with this section.
   2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in *Risk Category* I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   ((~~2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A2.~~))
   ((~~2.3~~)) 2.2. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A3.
   ((~~2.4~~)) 2.3. Seismic evaluation and design of soft, weak or open-front wall conditions in multiple-unit residential buildings of wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A4.
3. ASCE 41, using the performance objective in Table ((~~304.3.2~~)) 304.4.2 for the applicable *risk category*. Footnote a of Table 11.4.2 and Item 3 of Section 11.4.8 of ASCE 7 do not apply.

[BS] TABLE ((~~304.3.2~~)) 304.4.2
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH REDUCED SEISMIC FORCES

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1E EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
II	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
III	Damage Control (S-2). See Note a	Limited Safety (S-4). See Note b
IV	Immediate Occupancy (S-1)	Life Safety (S-3). See Note c

a. For Risk Categories I, II and III, the Tier 1 and Tier 2 procedures need not be considered for the BSE-1E earthquake hazard level.
b. For Risk Category III, the Tier 1 screening checklists shall be based on the Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on *MS*-factors that are the average of the values for Collapse Prevention and Life Safety.
c. For Risk Category IV, the Tier 1 screening checklists shall be based on Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on *MS*-factors for Life Safety.

[S] 304.5 Seismic regulations for unreinforced masonry buildings. *URM buildings* meeting any of the following criteria shall comply with Section 304.5.1:

1. Where there is a significant increase in the occupant load of a *URM building*, as determined by the code official.
2. *URM buildings* voluntarily seeking to be defined as a *retrofitted URM building*.

304.5.1 URM Seismic regulations. *URM buildings* shall comply or be altered to comply with one of the following:

1. Section 304.4.2;
2. Appendix Chapter A6, Alternate Method for the Seismic Improvement of *Unreinforced Masonry (URM) Buildings*;
3. Previously permitted and completed retrofits that comply with one of the following:
   a. *URM buildings* that have undergone a seismic retrofit due to a substantial alteration determination, permitted between September 16, 1996, and April 24, 2009, using the 1994 or later edition of the Seattle Building Code. A report confirming the retrofit work was completed shall be prepared by a licensed structural engineer and submitted to the code official.
   b. *URM buildings* that have undergone a seismic retrofit due to a substantial alteration determination, permitted after April 24, 2009, using the 2006 or later edition of the Seattle Building Code.
   c. Other seismic retrofits approved by the code official.

SECTION 305
IN-SITU LOAD TESTS

[BS] 305.1 General. Where used, in-situ load tests shall be conducted in accordance with Section 1708 of the *International Building Code*.

SECTION 306
ACCESSIBILITY FOR EXISTING BUILDINGS

[S] 306.1 Scope. The provisions of Sections 306.1 through 306.7.16 apply to maintenance and *repair*, *change of occupancy*, *additions* and *alterations* to *existing buildings*, including those identified as ((~~*historic buildings*~~)) *landmarks*.

306.2 Design. Buildings and *facilities* shall be designed and constructed to be accessible in accordance with this code and the *alteration* and *existing building* provisions in ICC A117.1, as applicable.

306.3 Maintenance and repair. A *facility* that is constructed or altered to be accessible shall be maintained accessible during occupancy. Required accessible means of egress shall be maintained during construction, demolition, remodeling or *alterations* and *additions* to any occupied building.

Exception: Existing means of egress need not be maintained where *approved* temporary means of egress and accessible means of egress systems and *facilities* are provided.

306.3.1 Prohibited reduction in accessibility. An *alteration* that decreases or has the effect of decreasing accessibility of a building, *facility* or element, thereof, below the requirements for new construction at the time of the *alteration* is prohibited. The number of accessible elements need not exceed that required for new construction at the time of *alteration*.

[S] 306.4 Extent of application. ((~~An~~)) Maintenance, *alterations*, *change of occupancy*, *additions* to or relocations of *existing buildings* of an existing *facility* shall not impose a requirement for greater accessibility than that which would be required for new construction.

[S] 306.5 Change of occupancy. *Existing buildings* that undergo a change of group or occupancy shall comply with Section 306.7.

Exception: Type B dwelling or sleeping units required by Section 1108 of the *International Building Code* are not required to be provided in *existing buildings* and *facilities* undergoing a *change of occupancy* in conjunction with *alterations* where the *work area* is 50 percent or less of the aggregate area of the building or less than a level 3 *alteration*.

[W] 306.6 Additions. Provisions for new construction shall apply to *additions*. An *addition* that affects the accessibility to, or contains an area of, a *primary function* shall comply with the requirements in Section 306.7.1. Limited-use/limited-application elevators installed in accordance with ASME A17.1 shall be permitted as a component of an accessible route connecting the existing construction to the addition.

306.7 Alterations. A *facility* that is altered shall comply with the applicable provisions in Chapter 11 of the *International Building Code,* ICC A117.1 and the provisions of Sections 306.7.1 through 306.7.16, unless *technically infeasible*. Where compliance with this section is *technically infeasible*, the *alteration* shall provide access to the maximum extent technically feasible.

[W] 306.7.1 Alterations affecting an area containing a primary function. Where an *alteration* affects the accessibility to, or contains an area of *primary function*, the route to the *primary function* area shall be accessible. ((~~The accessible route to~~)) Toilet facilities and drinking fountains serving the area of *primary function* ((~~area shall include toilet *facilities* and drinking fountains serving~~)) including the route from the area of *primary function* to these facilities, shall be accessible. Priority shall be given to the improvements affecting the accessible route to the *primary function* area.

Exceptions:

1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the *alterations* affecting the area of *primary function*.
2. This provision does not apply to *alterations* limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to *alterations* limited solely to mechanical systems, electrical systems, installation or *alteration* of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to *alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

306.7.2 Accessible means of egress. Accessible means of egress required by Chapter 10 of the *International Building Code* are not required to be added in existing *facilities*.

306.7.3 Alteration of Type A units. The *alteration* to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.

306.7.4 Type B units. Type B dwelling or sleeping units required by Section 1108 of the International Building Code are not required to be provided in *existing buildings* and *facilities* undergoing *alterations* where the *work area* is 50 percent or less of the aggregate area of the building.

306.7.5 Entrances. Where an *alteration* includes *alterations* to an entrance that is not accessible, and the *facility* has an accessible entrance, the altered entrance is not required to be accessible unless required by Section 306.7.1. Signs complying with Section 1112 of the *International Building Code* shall be provided.

306.7.6 Accessible route. Exterior accessible routes, including curb ramps, shall be not less than 36 inches (914 mm) minimum in width.

306.7.7 Elevators. Altered elements of existing elevators shall comply with ASME A17.1. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

[W] 306.7.8 Platform lifts. ((~~Platform~~)) Vertical and inclined platform (wheelchair) lifts complying with ICC A117.1 and installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

Limited-use/limited-application elevators installed in accordance with ASME A17.1 shall be permitted as a component of an accessible route.

[S] 306.7.9 Stairways and escalators in existing buildings. ((~~Where~~)) In *alterations*, *change of occupancy*, or *additions* where an escalator or stairway is added where none existed previously and major structural modifications are necessary for installation, an accessible route complying with Section 1104.4 of the *International Building Code* is required between levels served by such escalator or stairway.

306.7.10 Determination of number of units. Where Chapter 11 of the *International Building Code* requires Accessible, Type A or Type B units and where such units are being altered or added, the number of Accessible, Type A and Type B units shall be determined in accordance with Sections 306.7.10.1 through 306.7.10.3.

306.7.10.1 Accessible dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of Section 1108 of the *International Building Code* for Accessible units apply only to the quantity of spaces being altered or added.

[S] 306.7.10.2 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of Section 1108 of the *International Building Code* for Type A units and Chapter 9 of the International Building Code for visible alarms apply only to the quantity of the spaces being altered or added.

[S] 306.7.10.3 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, or R-3 ((~~or R-4~~)) dwelling or sleeping units are being added, the requirements of Section 1108 of the *International Building Code* for Type B units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, or R-3 ((~~or R-4~~)) dwelling or sleeping units are being altered and where the *work area* is greater than 50 percent of the aggregate area of the building, the requirements of Section 1108 of the *International Building Code* ((~~for Type B units~~)) apply only to the quantity of the spaces being altered.

Exception: When using the provisions of Chapter 9, Group I-1, I-2, R-2, or R-3 dwelling or sleeping units where the first *certificate of occupancy* was issued before March 15, 1991, are not required to provide Type B dwelling or sleeping units.

[S] 306.7.11 Toilet rooms. Where it is *technically infeasible* to alter existing toilet rooms to be accessible, one accessible single-user toilet room or one accessible family or assisted-use toilet room constructed in accordance with Section 1110.2.1 of the *International Building Code* is permitted. This toilet room shall be located on the same floor and in the same area as the existing toilet rooms. The number of toilet facilities and water closets required by the *International Building Code* is permitted to be reduced by one, in order to provide accessible features. At the inaccessible toilet rooms, provide directional signs indicating the location of the nearest such toilet room. ((~~shall be provided.~~)) These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.12 Bathing rooms. Where it is *technically infeasible* to alter existing bathing rooms to be accessible, one accessible single-user bathing room or one accessible family or assisted-use bathing room constructed in accordance with Section 1110.2.1 of the *International Building Code* is permitted. This accessible bathing room shall be located on the same floor and in the same area as the existing bathing rooms. At the inaccessible bathing rooms, directional signs indicating the location of the nearest such bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.13 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1110.2.1 of the *International Building Code*. In recreational *facilities*, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1110.2.1 of the *International Building Code*.

306.7.14 Dressing, fitting and locker rooms. Where it is *technically infeasible* to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex *facilities* are provided, accessible rooms for each sex shall be provided. Separate-sex *facilities* are not required where only unisex rooms are provided.

306.7.15 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1111.4.8 of the *International Building Code.*

[S] 306.7.16 ((~~Historic~~)) Accessibility provisions for landmark structures. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the ((~~historic~~)) *landmark* structure, as determined by the ((~~authority having jurisdiction~~)) *code official*, the alternative requirements of Sections 306.7.16.1 through 306.7.16.5 for that element shall be permitted.

Exceptions:

1. Accessible means of egress required by Chapter 10 of the *International Building Code* are not required to be provided in ((~~historic~~)) *landmark* structures.
2. The altered element or space is not required to be on an accessible route, unless required by Sections 306.7.16.1 or 306.7.16.2.

306.7.16.1 Site arrival points. Not fewer than one exterior accessible route, including curb ramps from a site arrival point to an accessible entrance, shall be provided and shall not be less than 36 inches (914 mm) minimum in width.

306.7.16.2 Multiple-level buildings and facilities. An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

306.7.16.3 Entrances. Where an entrance cannot be made accessible in accordance with Section 306.7.5, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1112 of the *International Building Code* shall be provided at the public entrances and the accessible entrance.

306.7.16.4 Toilet facilities. Where toilet rooms are provided, not fewer than one accessible single-user toilet room or one accessible family or assisted-use toilet room complying with Section 1110.2.1 of the *International Building Code* shall be provided.

306.7.16.5 Bathing facilities. Where bathing rooms are provided, not fewer than one accessible single-user bathing room or one accessible family or assisted-use bathing rooms complying with Section 1110.2.1 of the *International Building Code* shall be provided.

306.7.16.6 Type A units. The *alteration* to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.

[S] 306.7.16.7 Type B units. Type B dwelling or sleeping units required by Section 1108 of the *International Building Code* are not required to be provided in ((~~*historic buildings*~~)) *landmarks*.

** SECTION 307
SMOKE ALARMS

[S] 307.1 Smoke alarms. Where an *alteration*, *addition*, *change of occupancy* or relocation of a building is made to an *existing building* or structure of a Group R and I-1 occupancy, the *existing building* shall be provided with smoke alarms in accordance with the *International Fire Code*. ((~~or Section R314 of the *International Residential Code*.~~))

Exception: Work classified as Level 1 *Alterations* in accordance with Chapter 7.

** SECTION 308
CARBON MONOXIDE DETECTION

308.1 Carbon monoxide detection. Where an *addition*, *alteration*, *change of occupancy* or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the *existing building* shall be provided with carbon monoxide detection in accordance with the *International Fire Code* or Section R315 of the *International Residential Code*.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or *repairs* of plumbing or mechanical systems, other than fuel-burning appliances.
3. Work classified as Level 1 *Alterations* in accordance with Chapter 7.

SECTION 309
ADDITIONS AND REPLACEMENTS OF EXTERIOR WALL COVERINGS AND EXTERIOR WALL ENVELOPES

309.1 General. The provisions of Section 309 apply to all *alterations*, *repairs*, *additions*, relocations of structures and *changes of occupancy* regardless of compliance method.

309.2 Additions and replacements. Where an *exterior wall covering* or *exterior wall envelope* is added or replaced, the materials and methods used shall comply with the requirements for new construction in Chapter 14 and Chapter 26 of the *International Building Code* if the added or replaced *exterior wall covering* or *exterior wall envelope* involves two or more contiguous stories and comprises more than 15 percent of the total wall area on any side of the building.

[S] SECTION 310
LANDMARKS

[B] 310.1 Landmarks. The provisions of this code relating to the construction, *repair*, *alteration*, *addition*, restoration and movement of structures, and *change of occupancy* shall be mandatory for landmarks. Landmarks shall comply with the accessibility requirements of Section 306.7.16.

Exception: Where *approved* by the *code official*, compliance with this code is not required where preservation of historic elements precludes complete compliance and a reasonable degree of safety to the public and the occupants of the building is provided.

[S] SECTION 311
SUBSTANTIAL ALTERATION REQUIREMENTS FOR ALL COMPLIANCE METHODS

[S] 311.1 Substantial alterations or repairs. Regardless of which compliance method is used, a building or structure to which *substantial alterations* or *repairs* are made shall conform with the requirements of this section and the following sections of the *International Building Code*:

1. Section 403 when applicable;
2. Special requirements for the Fire District found in Chapter 4 when applicable;
3. Section 717;
4. Chapter 8;
5. Section 903 and 905;
6. Sections 909.20.5, 909.20.6 and 909.21; and
7. Chapter 10.
8. Fire alarms shall be provided as required by the *International Fire Code*.

[S] 311.1.1 Definition. For the purpose of this section, *substantial alteration* or repair means any one of the following, as determined by the *code official*:

1. *Repair* of a building with a *damage ratio* of 60 percent or more.
2. Remodeling or an *addition* that substantially extends the useful physical or economic life of the building or a significant portion of the building, other than typical tenant remodeling.
3. A change of a significant portion of a building to an occupancy that is more hazardous than the existing occupancy, based on the combined life and fire risk as determined by the *code official*. The *code official* is permitted to use Table 311.1 as a guideline.
4. Reoccupancy of a building that has been substantially vacant for more than 24 months in occupancies other than Group R-3.

[S] 311.1.2 Seismic regulations. Buildings or structures to which *substantial alterations* or *repairs* are made shall comply with Section 304.4.2. In addition, the *code official* is authorized to require testing of existing materials when there is insufficient evidence of structural strength or integrity.

Exceptions:

1. If an *alteration* is substantial only because it is a change to a more hazardous occupancy, compliance with this subsection is required only if the life hazard risk increases, as determined by the *code official*.
2. For Group R-3 occupancies, when approved by the *code official*, the applicant is permitted to evaluate and strengthen portions of the building lateral support structure, such as foundations and cripple walls.
3. For permitted one- or two- family dwellings, less than four stories above grade plane, that are *substantial alterations* due to a move into the SBC, the applicant is permitted to evaluate and strengthen portions of the building lateral support structure, such as foundations and cripple walls, subject to the approval of the *code official*.

[S] 311.1.3 Seismic evaluation report. A proposal for structural rehabilitation shall be submitted based on a comprehensive report prepared by a licensed structural engineer according to rules promulgated by the *code official*. The report shall include an investigation and structural analysis of the building based on Section 304.4.2. The report shall specify the building's seismic deficiencies, and propose measures that will provide an acceptable degree of seismic safety considering the nature, size and scope of the project. This requirement shall also apply to Section 101.14 as conditions require.

A seismic evaluation report is not required when Exceptions 2 or 3 of Section 311.1.2 are met.

[S] 311.1.4 Energy use regulations. An *alteration* or *repair* described in Items 1, 2, or 4 of Section 311.1.1 shall comply with Section C503.8 of the *International Energy Conservation Code*.

Exception: Existing residential buildings of three stories or less above grade plane are not required to comply with this section.

[S] TABLE 311.1
RATING OF OCCUPANCIES BY DEGREE OF HAZARD

OCCUPANCY	DESCRIPTION	LIFE	FIRE	COMBINED RATING
A1	Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures	4	3	12
A2	Assembly uses intended for food and/or drink consumption	4	3	12
A3	Assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A	4	3	12
A4	Assembly uses intended for viewing of indoor sporting events and activities with spectator seating	3	1	3
A5	Assembly uses intended for participation in or viewing outdoor activities	3	1	3
B	Office, professional or service-type transactions, including storage of records and accounts	2	1	2
B	Eating & drinking establishments with an occupant load of less than 50	2	1	2
B	Buildings or portions of buildings having rooms used for educational purposes beyond 12th grade	2	1	2
E	Any building used for educational purposes by six or more persons at any one time for educational purposes through the 12th grade	3	2	6
E	Day care centers for more than five children older than 2-1/2 years of age	3	2	6
I4	Facilities that provide accommodations for less than 24 hours for more than five unrelated adults and provides supervision and personal care services; facilities that provide supervision and personal care on less than a 24-hour basis for more than five children 2-1/2 years of age or less	4	3	12
F1	Moderate hazard factory and industrial	2	2	4
F2	Low-hazard factory and industrial	1	1	1
H1	Occupancies with a detonation hazard	5	4	20
H2	Occupancies which present a deflagration hazard or a hazard from accelerated burning	5	4	20
H3	Occupancies containing materials that readily support combustion or that pose a physical hazard	5	4	20
H4	Occupancies containing materials that are health hazards	5	4	20
H5	Semiconductor fabrication facilities	5	4	20
I1	Buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care	3	3	9
I2	Buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation	4	3	12
I3	Buildings and structures that are inhabited by more than five persons who are under restraint or security	4	3	12
M	Buildings used for display and sale of merchandise	3	2	6
R1	Occupancies containing sleeping units where the occupants are primarily transient in nature	3	3	9
R2	Occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature	3	3	9
R3	Residential 3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, or I	2	1	2
S1	Moderate hazard storage	2	2	4
S2	Low-hazard storage	1	1	1
U	Buildings and structures of an accessory character and miscellaneous structures	1	1	1

[S] SECTION 312 REROOFING **

[BS] 312.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the *International Building Code* and the *International Energy Conservation Code*. **

Exceptions:

1. *Roof replacement* or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the *International Building Code* for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the *International Building Code* for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the *International Building Code*.

[BS] 312.2 Structural and construction loads. ((~~Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.~~)) Where addition or replacement of roofing or replacement of equipment results in additional dead loads, structural components supporting the reroofing equipment shall comply with Section 304.1. **

[BS] 312.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck. **

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the *International Building Code*.

[BS] 312.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. The new roof covering is installed in accordance with the roof covering manufacturer's *approved* instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, are installed.
3. Metal panel, metal shingle and concrete and clay tile roof coverings are installed over existing wood shake roofs in accordance with Section 312.4.
4. A new protective *roof coating* is applied over an existing protective *roof coating*, a metal roof panel, metal roof shingles, mineral-surfaced roll roofing, a built-up roof, modified bitumen roofing, thermoset and thermoplastic single-ply roofing or a spray polyurethane foam roofing system.

[BS] 312.3.1.1 Exceptions. A roof recover shall not be permitted where any of the following conditions occur:

1. The existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. The existing roof covering is slate, clay, cement or asbestos-cement tile.
3. The existing roof has two or more applications of any type of roof covering.

[BS] 312.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other *approved* materials securely fastened in place. **

[BS] 312.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled. **

[BS] 312.6 Flashings. Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation. **

[S] SECTION 313 RELOCATED BUILDINGS AND STRUCTURES

313.1 Nonresidential buildings or structures. Nonresidential buildings or structures relocated into or within the city shall comply with standards adopted by the *code official*. The *code official* is authorized to require an inspection of the building before or after relocation. The permit holder shall correct all deficiencies identified by the inspection. The *code official* is

authorized to require that a bond or cash deposit in an amount sufficient to abate or demolish the building be posted prior to issuance of a permit. See Section 106 of the *International Building Code* for information required on plans. Any relocated building that is not in complete compliance with standards for relocated buildings within 18 months from the date of permit issuance and is found to be a public nuisance may be abated. Relocated buildings and structures shall also comply with the *International Energy Conservation Code*.

313.2 Residential buildings or structures. Residential buildings or structures relocated into or within the city are not required to comply with all of the requirements of this code if the original occupancy classification of the building or structure is not changed. Compliance with all of the requirements of this chapter will be required if the relocated residential buildings or structures undergo substantial alteration. Work performed on new and existing foundations shall comply with all of the requirements of this code for new construction.

[S] SECTION 314
FLOOD HAZARD AREAS

[BS] 314.1 Flood hazard areas. Buildings and structures in flood hazard areas established in Section 1612.3 of the *International Building Code* shall comply with Sections 314.1.1 through 314.1.3.

((~~In *flood hazard areas, alterations* that~~)) When any combination of *repairs*, *alterations*, or *additions* constitute *substantial improvement*, ((~~shall require that~~)) the *existing building* and all *repairs*, *alterations*, and *additions* shall comply with Section 1612 of the *International Building Code*. ((~~, or Section R322 of the *International Residential Code*, as applicable.~~))

314.1.1 Repairs. Any *repair* that constitutes *substantial improvement* of the existing structure or buildings that have been substantially damaged, as defined in Section 202, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design according to Section 1612 of the *International Building Code*.

Any *repairs* that do not constitute *substantial improvement* or *repair* of *substantial damage* of the existing structure, as defined in Section 202, are not required to comply with the flood design requirements for new construction according to Section 1612 of the *International Building Code*.

Exception: For a new foundation or replacement foundation, the foundation shall comply with Section 1612 of the *International Building Code*.

314.1.2 Alterations. *Alterations* that constitute *substantial improvement* of the existing structure shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design according to Section 1612 of the *International Building Code*.

Any alterations that do not constitute *substantial improvement* of the existing structure are not required to comply with the flood design requirements for new construction according to Section 1612 of the *International Building Code*.

Exception: For a new foundation or replacement foundation, the foundation shall comply with Section 1612 of the International Building Code.

314.1.3 Additions. *Additions* shall comply with the flood design requirements for new construction according to Section 1612 of the *International Building Code*. If the *addition* constitutes *substantial improvement*, the existing structure shall be brought into compliance with the requirements for new construction for flood design according to Section 1612 of the *International Building Code*.

CHAPTER 4
REPAIRS

User note:

About this chapter: *Chapter 4 provides requirements for repairs of existing buildings. The provisions define conditions under which repairs may be made using materials and methods like those of the original construction or the extent to which repairs must comply with requirements for new buildings.*

SECTION 401
GENERAL

[S] 401.1 Scope. ((~~*Repairs* shall comply with the requirements of this chapter. *Repairs* to *historic buildings* need only comply with Chapter 12.~~)) Damaged buildings and structures, and parts thereof, shall be *repaired* in compliance with this chapter. Work on undamaged parts of a building or structure that is necessary for the required *repair* of damaged parts shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* except as specifically required in this chapter. Routine maintenance, ordinary *repairs* exempt from permit in accordance with *International Building Code* Section 106.2, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

401.1.1 Bleachers, grandstands and folding and telescopic seating. *Repairs* to existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

[S] 401.1.2 Determining repair levels. *Repairs* shall be classified as *repair* of minor damage, *repair* of moderate damage, *repair* of significant damage, or repair of extensive damage. Required *repair* levels shall be based on the *damage ratio* as defined in Section 202. *Damage ratios* shall be determined according to rules promulgated by the Director.

[S] 401.1.3 Requirements for repair of minor damage. *Repair* of buildings with *damage ratios* less than 10 percent shall comply with this Section 401.1.3. Repair of unreinforced masonry chimneys shall comply with Section 302.9.

1. Damage to structural elements and fire/life safety systems shall be repaired.
2. New or replaced elements shall comply with current code requirements.

   Exception: Like materials shall be permitted for nonstructural alterations, provided no hazard to life, health or property is created, and the materials do not adversely affect any structural member or result in a change to the fire-resistance rating of any part of the building or structure.
3. New or replaced structural elements shall be tied into new or existing structure in accordance with the structural engineer's recommendations and accepted practice.
4. All structural *repairs* shall be designed and approved by a structural engineer licensed in the State of Washington.
5. Cracked concrete and masonry shall be repaired if repair is required by FEMA 306, 307 and 308.
6. Strengthening of the entire building or structure is not required.
7. Fire protection and life safety systems required when the building was built or altered shall be repaired in accordance with Section 101.5.
8. No portion of the building shall be repaired in such a manner that the building becomes less safe than it was before the damage occurred, nor shall the repair create an unsafe condition as defined in Section 101.14.

[S] 401.1.4 Requirements for repair of moderate damage. *Repair* of buildings with *damage ratios* of at least 10 percent and less than 30 percent shall comply with Section 401.1.3 and this Section 401.1.4. All structures supporting and supported by the damaged portions of the building shall be repaired in accordance with items 1 through 6 below.

1. The capacity of existing structural elements supporting and supported by the damaged portion of the building shall not be less than the capacity of those elements before the damage occurred.
2. The lateral loading to existing elements of the lateral force resisting systems shall not be increased beyond their capacity.
3. New work shall not introduce new irregularities, and shall not worsen existing irregularities.
4. New structural elements shall be detailed and connected to the existing structural elements as required by this code.
5. New or relocated nonstructural elements shall be detailed and connected to existing or new structural elements as required by this code.
6. The *alterations* shall not create an *unsafe* condition.

[S] 401.1.5 Requirements for repair of significant damage. *Repair* of buildings with *damage ratios* of at least 30 percent and less than 50 percent shall comply with Sections 401.1.3 and 401.1.4 and this Section 401.1.5.

1. The engineer shall submit a report identifying structural damage, and falling hazards to exitways, pedestrian walkways and public rights-of-way. The report shall also contain a statement acknowledging that compliance with this section may not satisfy the requirements for *substantial alteration* of Section 311.
2. All identified falling hazards in exits and exit discharges shall be mitigated so as to limit damage at primary means of egress.
3. The walls, roofs and floors of unreinforced masonry buildings shall comply with the sections of ASCE 41 or Appendix A1 as shown in Table 401.1. Seismic forces shall comply with reduced International Building Code forces per Section 304.4.2.

   Exception: If the tested mortar strength is less than the minimums indicated in Table 401.1, Item a, the structure shall comply with all requirements of Section 304.4.2.
4. Repair of damage for buildings subject to this Section 401.1.5 will be considered when determining whether Section 311 provisions for *substantial alterations* apply.

[S] 401.1.6 Requirements for repair of extensive damage. *Repair* of buildings with *damage ratios* of at least 50 percent and less than 60 percent shall comply with Sections 401.1.3 through 401.1.5 and this Section 401.1.6.

1. The structure shall be *repaired* and designed to satisfy the requirements of ASCE 41 and the performance criteria in Table 304.4.2.
2. A seismic evaluation report shall be submitted. The report shall comply with rules promulgated by the *code official*, and the following requirements:
   - 2.1. The report shall be prepared by a structural engineer registered in the state of Washington.
   - 2.2. The report shall be based on ASCE 41 and the performance criteria in Table 304.4.2.

     Exception: Unreinforced masonry buildings are permitted to comply with Appendix A1. The reduction of Section 401.1.5 Item 3 is not allowed.
   - 2.3. At a minimum, the report shall contain the information listed below. A previously written report may be submitted if it satisfies the requirements of this section.
     - 2.3.1. An overall description of the building, including size (number of stories and basements, approximate floor area) and the occupancies or uses in the building.
     - 2.3.2. Identification of building deficiencies.

[S] 401.1.7 Requirements for repair of more than extensive damage. Repair of buildings with damage ratios of 60% or more shall comply with Section 311.

[S] TABLE 401.1
REQUIREMENTS FOR UNREINFORCED MASONRY BUILDINGS

COMPONENT	ASCE 41 SECTION	APPENDIX A SECTION
a. Masonry strength (mortar and anchor tests) for anchorage to masonry and for wall bracing	16.2.2.2	A106.2.3
b. Diaphragm shear transfer	16.2.3.2.6	A111.5
c. Out-of-plane transfer	16.2.4.3	A113.1
d. Wall bracing	16.2.4.2	A113.5

[W] 401.2 Compliance. The work shall not make the building less complying than it was before the *repair* was undertaken. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to requirements for alterations.

[S][BS] 401.3 Flood hazard areas. In flood hazard areas, *repairs* that constitute a *substantial improvement* of the existing structure or buildings that have been *substantially damaged* shall ((~~require that the building~~)) comply with ((~~Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable~~)) the requirements for repairs in Section 314 of this code.

[W] 401.4 Demolition and replacement. Where a building or structure is effectively demolished by damage or where the intended method of repair is demolition and replacement, the replaced building, including its replaced foundation, shall comply with requirements for new construction in the *International Building Code*.

Exception: Existing foundations are permitted to remain and be reused where approved by the *code official*.

SECTION 402
BUILDING ELEMENTS AND MATERIALS

402.1 Glazing in hazardous locations. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the *International Building Code* or *International Residential Code* as applicable.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

SECTION 403
FIRE PROTECTION

403.1 General. *Repairs* shall be done in a manner that maintains the level of fire protection provided.

SECTION 404
MEANS OF EGRESS

404.1 General. *Repairs* shall be done in a manner that maintains the level of protection provided for the means of egress.

SECTION 405
STRUCTURAL

[S][BS] 405.1 General. Structural *repairs* shall be in compliance with ((~~this section and~~)) Section ((~~401.2~~)) 304.

[W][S] 405.1.1 Structural concrete repairs. Repair of structural concrete is permitted to comply with ACI 562 Section 1.7, except where the damage is more than moderate.

[S] ((~~[BS] 405.2 Repairs to damaged buildings.~~ ~~*Repairs* to damaged buildings shall comply with this section.~~

~~**[BS] 405.2.1 Repairs for less than substantial structural damage.** Unless otherwise required by this section, for damage less than *substantial structural damage*, the damaged elements shall be permitted to be restored to their predamage condition.~~

~~**[BS] 405.2.1.1 Snow damage.** Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the *International Building Code*.~~

~~**[BS] 405.2.2 Disproportionate earthquake damage.** A building assigned to Seismic Design Category D, E or F that has sustained *disproportionate earthquake damage* shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.~~

~~**[BS] 405.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system.** A building that has sustained *substantial structural damage* to the vertical elements of its lateral force-resisting system shall be evaluated in accordance with Section 405.2.3.1, and either repaired in accordance with Section 405.2.3.2 or repaired and retrofitted in accordance with Section 405.2.3.3, depending on the results of the evaluation.~~

~~**Exceptions:**~~

1. ~~Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.~~
2. ~~One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.~~

~~**[BS] 405.2.3.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the *code official*. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of the *International Building Code* for load combinations that include wind or earthquake effects, except that the seismic forces shall be the reduced seismic forces.~~

~~**[BS] 405.2.3.2 Extent of repair for compliant buildings.** If the evaluation establishes that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.~~

~~**[BS] 405.2.3.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the building shall be retrofitted to comply with the provisions of this section. The wind loads for the *repair* and *retrofit* shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the *International Building Code*. The seismic loads for this *retrofit* design shall be those required by the building code in effect at the time of original construction, but not less than the reduced seismic forces.~~

[BS] 405.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained *substantial structural damage* shall be rehabilitated to comply with the applicable provisions for dead, live and snow loads in the *International Building Code*. Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the *rehabilitation* design.

[BS] 405.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force resisting system, if *substantial structural damage* to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 405.2.3.1 and, if noncompliant, retrofitted in accordance with Section 405.2.3.3.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] 405.2.5 Substantial structural damage to snow load-carrying components. Where substantial structural damage to any snow load-carrying components is caused by or related to snow load effects, any components required to carry snow loads on roof framing of similar construction shall be repaired, replaced or retrofitted to satisfy the requirements of Section 1608 of the *International Building Code*.

[BS] 405.2.6 Flood hazard areas. In *flood hazard* areas, buildings that have sustained *substantial damage* shall be brought into compliance with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.))

[S] ((SECTION 406 ELECTRICAL

406.1 Material. Existing electrical wiring and equipment undergoing *repair* shall be allowed to be repaired or replaced with like material.

406.1.1 Receptacles. Replacement of electrical receptacles shall comply with the applicable requirements of Section 406.4(D) of NFPA 70.

406.1.2 Plug fuses. Plug fuses of the Edison base type shall be used for replacements only where there is no evidence of over fusing or tampering per applicable requirements of Section 240.51(B) of NFPA 70.

406.1.3 Nongrounding-type receptacles. For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system or to any accessible point on the grounding electrode conductor in accordance with Section 250.130(C) of NFPA 70.

406.1.4 Health care facilities. Portions of electrical systems being repaired in Group I-2, ambulatory care *facilities* and outpatient clinics shall comply with NFPA 99 requirements for *repairs*.

406.1.5 Grounding of appliances. Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances shall be permitted to be grounded to the grounded circuit conductor in accordance with Section 250.140 of NFPA 70.))

[S] ((SECTION 407 MECHANICAL

407.1 General. Existing mechanical systems undergoing *repair* shall not make the building less complying than it was before the damaged occurred.

407.2 Mechanical draft systems for manually fired appliances and fireplaces. A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such a system complies with all of the following requirements:

1. The mechanical draft device shall be listed and installed in accordance with the manufacturer's installation instructions.

~~2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.~~

~~3. A smoke detector shall be installed in the room with the appliance or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.~~))

[S] ((~~SECTION 408 PLUMBING~~

~~**408.1 Materials.** Plumbing materials and supplies shall not be used for *repairs* that are prohibited in the *International Plumbing Code*.~~

~~**408.2 Water closet replacement.** The maximum water consumption flow rates and quantities for all replaced water closets shall be 1.6 gallons (6 L) per flushing cycle.~~

~~**Exception:** Blowout design water closets [3.5 gallons (13 L) per flushing cycle].~~

~~**408.3 Health care facilities.** Portions of medical gas systems being repaired in Group I-2, ambulatory care *facilities* and outpatient clinics shall comply with NFPA 99 requirements for *repairs*.~~))

CHAPTER 5
PRESCRIPTIVE COMPLIANCE METHOD

User note:

About this chapter: *Chapter 5 provides details for the prescriptive compliance method—one of the three main options of compliance available in this code for buildings and structures undergoing alteration, addition or change of occupancy.*

SECTION 501
GENERAL

[S] 501.1 Scope. The provisions of this chapter shall control the *alteration*, *addition* and *change of occupancy* of *existing buildings* and structures. ((~~, including *historic buildings* and structures as referenced in Section 301.3.1.~~))

[S] 501.1.1 Compliance with other methods. *Alterations*, *additions* and *changes of occupancy* to *existing buildings* and structures shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.

Note: All *alterations*, *additions* and *changes of occupancy* are also required to comply with Chapter 3.

501.2 Fire-resistance ratings. Where *approved* by the *code official*, in buildings where an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code* has been added, and the building is now sprinklered throughout, the required fire-resistance ratings of building elements and materials shall be permitted to meet the requirements of the current building code. The building is required to meet the other applicable requirements of the *International Building Code*.

Plans, investigation and evaluation reports, and other data shall be submitted indicating which building elements and materials the applicant is requesting the *code official* to review and approve for determination of applying the current building code fire-resistance ratings. Any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, *approved* modifications or *approved* alternative materials, design and methods of construction, and equipment applying to the building that impact required fire-resistance ratings shall be identified in the evaluation reports submitted.

[S] 501.3 Health care facilities. In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any altered or added portion of an existing electrical or medical gas systems shall be required to meet installation and equipment requirements in ((~~NFPA 99~~)) *Seattle Electrical Code* and NFPA 99 for *medical gas systems*.

SECTION 502
ADDITIONS

[S] 502.1 General. *Additions* to any building or structure shall comply with the requirements of the *International Building Code* for new construction. *Alterations* to the *existing building* or structure shall be made to ensure that the *existing building* or structure together with the *addition* are not less complying with the provisions of the *International Building Code* than the *existing building* or structure was prior to the *addition*. An *existing building* together with its *additions* shall comply with the height and area provisions of Chapter 5 of the *International Building Code*.

Note: A significant addition to an existing building may be considered a substantial alteration in accordance with Section 307.

[S] 502.1.1 Fire walls. An existing nonconforming building to which an *addition* is made is permitted to exceed the height, number of stories and area specified for new buildings if a fire wall is provided, the *existing building* is not made more nonconforming, and the *addition* conforms to this code.

[S][BS] ((~~502.2 Disproportionate earthquake damage.~~ ~~A building assigned to Seismic Design Category D, E or F that has sustained *disproportionate earthquake damage* shall be subject to the requirements for buildings with *substantial structural damage* to vertical elements of the lateral force-resisting system.~~))

[S] 502.2 Structural. *Additions* to *existing buildings* shall comply with Section 304.3.

[S] 502.3 Addition of dwelling units. Automatic sprinkler systems are required when new dwelling units are added to buildings according to Items 1 through 5 below. This provision is permitted to be used to add one unit after October 29, 1990.

PRESCRIPTIVE COMPLIANCE METHOD

1. One unit is permitted to be added to a residential or commercial building without an automatic sprinkler system unless sprinklers are otherwise required by this section. If more than one unit is added, the new units shall be equipped with a sprinkler system.
2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the unit is added, an automatic sprinkler system shall be provided in the new unit. The addition of the new unit shall not be allowed if it increases the nonconformity.
3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.
4. One unit is permitted to be added to an existing duplex without an automatic sprinkler system where both of the following conditions are met:
   4.1. The project is considered a *substantial alteration* only because of the change of occupancy; and
   4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.
5. Where one unit is added to an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:
   5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;
   5.2. The project is considered a *substantial alteration* only because of the *change of occupancy*;
   5.3. The new unit is constructed as an *addition* to the duplex;
   5.4. The new unit is separated from the existing duplex by a fire wall; and
   5.5. The *addition* by itself complies with the requirements for a Group R-2 occupancy.

((~~502.6~~)) 502.4 Enhanced classroom acoustics. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the *addition* with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

SECTION 503
ALTERATIONS

[S] 503.1 General. *Alterations* to any building or structure shall comply with the requirements of the *International Building Code* for new construction. *Alterations* shall be such that the *existing building* or structure is not less complying with the provisions of the *International Building Code* than the *existing building* or structure was prior to the *alteration*.

Exceptions:

1. ((~~An~~)) Subject to the approval of the *code official*, existing stairways shall not be required to comply with the requirements of Sections 1011.3 and 1011.5.2 of the *International Building Code* where the existing space and construction ((~~does~~)) do not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1011.11 of the *International Building Code* shall not be required to comply with the requirements of Section 1014.6 of the *International Building Code* regarding full extension of the handrails where such extensions would be hazardous because of plan configuration.
3. Where changes to offices, outpatient clinics or medical offices occur on a multi-tenant floor that contains nonconforming corridors, new tenant walls associated with the tenant change need not meet the standards for one-hour corridor construction, unless the project is considered a *substantial alteration*.
4. Automatic sprinkler systems are required when new dwelling units are added to buildings according to Items 4.1 through 4.6 below. This exception is permitted to be used to add one unit after October 29, 1990.
   4.1. One unit is permitted to be added to a residential or commercial building without an automatic sprinkler system unless sprinklers are otherwise required by this section. If more than one unit is added, the new units shall be equipped with a sprinkler system.
   4.2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the unit is added, an automatic sprinkler system shall be provided in the new unit. The addition of the new unit shall not be allowed if it increases the nonconformity.
   4.3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.

4.4. One unit is permitted to be added to an existing duplex without an automatic sprinkler system where both of the following conditions are met:

4.4.1. The project is considered a *substantial alteration* only because of the *change of occupancy*; and

4.4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.

4.5. Where one unit is added to an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:

4.5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;

4.5.2. The project is considered a *substantial alteration* only because of the *change of occupancy*;

4.5.3. The new unit is constructed as an *addition* to the duplex;

4.5.4. The new unit is separated from the existing duplex by a fire wall; and

4.5.5. The addition by itself complies with the requirements for a Group R-2 occupancy.

4.6. A sprinkler system is not required when a Group U occupancy that is accessory to a Group R-3 occupancy is converted to a dwelling unit.

5. Ceilings in basements are permitted to project to within 6 feet 8 inches (2032 mm) of the finished floor, and beams, girders, ducts or other obstructions are permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor.

6. Ceiling height in buildings in existence prior to October 17, 1979, shall be permitted to comply with rules promulgated by the code official.

((~~3~~)) 7. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).

[S] 503.2 Structural. *Alterations* to *existing buildings* and structures shall comply with Section 304.1. *

[S] ((~~[BS] 503.5 Seismic Design Category F.~~ ~~Where the *work area* exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category F, the structure of the altered building shall meet the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced seismic forces shall be permitted.~~)) *

[S] ((~~[BS] 503.6 Bracing for unreinforced masonry parapets on reroofing.~~ ~~Where the intended *alteration* requires a permit for reroofing and involves removal of roofing materials from more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall include installation of parapet bracing to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.~~))

[S] ((~~[BS] 503.7 Anchorage for concrete and reinforced masonry walls.~~ ~~Where the *work area* exceeds 50 percent of the building area, the building is assigned to Seismic Design Category C, D, E or F and the building's structural system includes concrete or reinforced masonry walls with a flexible roof diaphragm, the *alteration* work shall include installation of wall anchors at the roof line, unless an evaluation demonstrates compliance of existing wall anchorage. Use of reduced seismic forces shall be permitted.~~)) *

[S] ((~~[BS] 503.9 Bracing for unreinforced masonry parapets in major alterations.~~ ~~Where the *work area* exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category C, D, E or F, parapets constructed of unreinforced masonry shall have bracing installed as needed to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.~~)) *

[S] ((~~[BS] 503.11 Substantial structural alteration.~~ ~~Where the *work area* exceeds 50 percent of the building area and where work involves a *substantial structural alteration*, the lateral load-resisting system of the altered building shall satisfy the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced seismic forces shall be permitted.~~ *

~~**Exceptions:**~~

~~1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *International Building Code* or in compliance with the provisions of the *International Residential Code*.~~

~~2. Where the intended *alteration* involves only the lowest story of a building, only the lateral load-resisting components in and below that story need comply with this section.~~))

[S] ((~~[BS] 503.12 Roof diaphragms resisting wind loads in high wind regions.~~ ~~Where the intended *alteration* requires a permit for reroofing and involves removal of roofing materials from more than 50 percent of the roof diaphragm of a building or section of a building located where the ultimate design wind speed is greater than 130 mph (58 m/s) in accordance with Figure 1609.3(1) of the *International Building Code*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof to wall connections shall be evaluated for the wind loads specified in Section 1609 of the *International*~~

~~*Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in Section 1609 of the *International Building Code*.~~

~~**Exception:** Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7-88 or later editions.~~))

* **((~~503.14~~)) 503.3 Smoke compartments.** In Group I-2 occupancies where the *alteration* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the *International Building Code* as required for new construction.

* **((~~503.15~~)) 503.4 Refuge areas.** Where *alterations* affect the configuration of an area utilized as a refuge area, the capacity of the refuge area shall not be reduced below the required capacity of the refuge area for horizontal exits in accordance with Section 1026.4 of the *International Building Code*.

Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and Group B ambulatory care *facilities* shall not be reduced below that required in Sections 407.5.3, 408.6.2, 420.6.1 and 422.3.2 of the *International Building Code,* as applicable.

➡ **((~~503.16~~)) 503.5 Enhanced classroom acoustics.** In Group E occupancies, where the *work area* exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

((~~503.17~~)) 503.6 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the *International Building Code*.

((~~503.18~~)) 503.7 Two-way communications systems. Where the *work area* for *alterations* exceeds 50 percent of the building area and the building has elevator service, a two-way communication systems shall be provided where required by Section 1009.8 of the *International Building Code*.

SECTION 504
FIRE ESCAPES

[S][BE] 504.1 Where permitted. Fire escapes that are altered shall ((~~be permitted only as provided for in Sections 504.1.1 through 504.1.4~~)) comply with this section. Existing fire escapes shall continue to be accepted as a component in the means of egress in *existing buildings* only.

((~~**[BE] 504.1.1 New buildings.** Fire escapes shall not constitute any part of the required means of egress in new buildings.~~

~~**[BE] 504.1.2 Existing fire escapes.** Existing fire escapes shall continue to be accepted as a component in the means of egress in *existing buildings* only.~~

~~**[BE] 504.1.3 New fire escapes.** New fire escapes for *existing buildings* shall be permitted only where exterior stairways cannot be utilized because of lot lines limiting stairway size or because of sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.~~

~~**[BE] 504.1.4 Limitations.** Fire escapes shall comply with this section and shall not constitute more than 50 percent of the required number of exits nor more than 50 percent of the required exit capacity.~~))

[S][BE] 504.2 Location. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall be not less than ((~~7 feet (2134 mm)~~)) 8 feet (2438 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall be not less than 12 feet (3658 mm).

[S][BE] 504.3 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other *approved noncombustible materials*. ((~~Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Type III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.~~))

[BE] 504.4 Dimensions. Stairways shall be not less than 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm) and landings at the foot of stairways not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than 8 inches (203 mm) below the door.

[BE] 504.5 Opening protectives. Doors and windows within 10 feet (3048 mm) of fire escape stairways shall be protected with 3/4-hour opening protectives.

Exception: Opening protection shall not be required in buildings equipped throughout with an *approved* automatic sprinkler system.

SECTION 505
WINDOWS AND EMERGENCY ESCAPE OPENINGS

505.1 Replacement windows. The installation or replacement of windows shall be as required for new installations.

[S] 505.2 Window opening control devices on replacement windows. In Group R-2 or R-3 buildings containing dwelling units, ((~~and one- and two-family dwellings and townhouses regulated by the *International Residential Code*,~~)) window opening control devices or fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
   2.1. The window replacement includes replacement of the sash and frame.
   2.2. The window replacement includes the sash only where the existing frame remains.
3. One of the following applies:
   3.1. In Group R-2 or R-3 buildings containing dwelling units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.
   ((~~3.2. In one- and two-family dwellings and townhouses regulated by the *International Residential Code*, the bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.~~))
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.
5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the bottom of the clear opening of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2006.

[S] 505.3 Replacement window emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings* in Group R-2 and R-3 occupancies ((~~and one- and two-family dwellings and townhouses regulated by the *International Residential Code*,~~)) replacement windows shall be exempt from the requirements of Section 1031.3 of the *International Building Code* and Section R310.2 of the *International Residential Code*, provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement of the window is part of a *change of occupancy,* it shall comply with Section 1011.5.6.

505.3.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings*. After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys or tools.

[S] 505.4 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over *emergency escape and rescue openings*, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:

1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the emergency escape and rescue openings.

((~~4. Smoke alarms shall be installed in accordance with Section 907.2.10 of the *International Building Code*.~~))

SECTION 506
CHANGE OF OCCUPANCY

[S] 506.1 Compliance. A *change of occupancy* shall not be made in any building or portion thereof unless that building is made to comply with the requirements of the *International Building Code* for the use or occupancy. Changes of occupancy in a building or portion thereof shall be such that the *existing building* is not less complying with the provisions of ((~~this code~~))

the *International Building Code* than the *existing building* or structure was prior to the change. Subject to the approval of the *code official*, changes of occupancy shall be permitted without complying with all of the requirements of this code for the new occupancy, provided that the new occupancy is less hazardous, based on life and fire risk, than the existing occupancy.

Note: Conditions arising after the adoption of this code, and conditions not legally in existence at the time of adoption of this code may trigger requirements based on *International Fire Code* Section 102.1, including building upgrades.

Exceptions:

1. The building need not be made to comply with Chapter 16 of the *International Building Code* unless required by Section ((~~506.5~~)) 304.2.
2. Subject to the approval of the *code official*, an automatic sprinkler system is not required in dwelling units according to Items 2.1 through 2.6 below. This exception is permitted to be used for the change in occupancy for one dwelling unit after October 29, 1990.
   - 2.1. The occupancy of one unit is permitted to be changed to a dwelling unit without an automatic sprinkler system unless sprinklers are otherwise required by this chapter. If more than one unit is changed, the new units shall be equipped with a sprinkler system.
   - 2.2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the occupancy of the unit is changed, an automatic sprinkler system shall be provided in the new unit. The *change of occupancy* shall not be allowed if it increases the nonconformity.
   - 2.3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.
   - 2.4. The occupancy of one unit is permitted to be changed to a dwelling unit in an existing duplex without an automatic sprinkler system where both of the following conditions are met:
     - 2.4.1. The project is considered a *substantial alteration* only because of the *change of occupancy*; and
     - 2.4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.
   - 2.5. Where the occupancy of one unit is changed to a dwelling unit in an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:
     - 2.5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;
     - 2.5.2. The project is considered a *substantial alteration* only because of the *change of occupancy*;
     - 2.5.3. The new unit is constructed as an *addition* to the duplex;
     - 2.5.4. The new unit is separated from the existing duplex by a fire wall; and
     - 2.5.5. The addition by itself complies with the requirements for a Group R-2 occupancy.
   - 2.6. A sprinkler system is not required when a Group U occupancy that is accessory to a Group R-3 occupancy is converted to a dwelling unit.

[W][S] 506.1.1 Change in the ((~~character of~~)) group or use. A change of occupancy with no *change of occupancy* classification shall not be made to any structure that will subject the structure to any special provisions of the applicable International Codes, Uniform Plumbing Code, and Seattle Electrical Code, without approval of the *code official*. Compliance shall be only as necessary to meet the specific provisions and is not intended to require the entire building be brought into compliance.

Note: The following illustrate how *change of occupancy* is interpreted:
- Change in classification is a change in the letter designation. An example is a change from B occupancy to R occupancy.
- Change in occupancy group is change in the number designation within an occupancy classification. An example is a change from group R-1 occupancy to R-2 occupancy.
- Change of use is a change in the subcategory within the occupancy group. An example is a change from R-2 apartment to R-2 boarding house.

[S] ((~~506.2 Certificate of occupancy.~~ ~~A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.~~))

[S] 506.2 Conversion to residential occupancy. Upon conversion of an *existing building*, or portion thereof, to residential occupancy, *International Building Code* Sections 420, 1203 and 2902 shall apply, and the elements of the dwelling unit envelope that are altered shall comply with the sound transmission control requirements of *International Building Code* Section 1206.

[S] 506.3 Stairways. ((~~An~~)) Subject to the approval of the *code official*, existing stairways shall not be required to comply with the requirements of Section 1011 of the *International Building Code* where the existing space and construction does not allow a reduction in pitch or slope.

506.4 Existing emergency escape and rescue openings. Where a *change of occupancy* would require an *emergency escape and rescue opening* in accordance with Section 1031.1 of the *International Building Code*, operable windows serving as the *emergency escape and rescue opening* shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
   2.1. The replacement window meets the size requirements in Item 1.
   2.2. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

[S] 506.5 Structural. Any building undergoing a *change of occupancy* that results in the building being reclassified to a higher risk category shall satisfy the requirements of ((~~this section~~)) Section 304.2.

((~~**506.5.1 Live loads.** Structural elements carrying tributary live loads from an area with a *change of occupancy* shall satisfy the requirements of Section 1607 of the *International Building Code*. Design live loads for areas of new occupancy shall be based on Section 1607 of the *International Building Code*. Design live loads for other areas shall be permitted to use previously *approved* design live loads.~~

~~**Exception:** Structural elements whose demand-capacity ratio considering the *change of occupancy* is not more than 5 percent greater than the demand-capacity ratio based on previously *approved* live loads need not comply with this section.~~

~~**506.5.2 Snow and wind loads.** Where a *change of occupancy* results in a structure being assigned to a higher *risk category*, the structure shall satisfy the requirements of Sections 1608 and 1609 of the *International Building Code* for the new *risk category*.~~

~~**Exception:** Where the area of the new occupancy is less than 10 percent of the building area, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.~~

~~**506.5.4 Access to Risk Category IV.** Any structure that provides operational access to an adjacent structure assigned to *Risk Category* IV as the result of a *change of occupancy* shall itself satisfy the requirements of Sections 1608, 1609 and 1613 of the *International Building Code*. For compliance with Section 1613, *International Building Code*-level seismic forces shall be used. Where operational access to the *Risk Category* IV structure is less than 10 feet (3048 mm) from either an interior lot line or from another structure, access protection from potential falling debris shall be provided.~~)) *

506.6 Enhanced classroom acoustics. In Group E occupancies, where the *work area* exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

[S] 506.7 Substantial alterations. *Changes of occupancy* that are *substantial alterations* shall comply with Section 311.

[S] SECTION 507
((~~HISTORIC BUILDINGS~~)) LANDMARKS

507.1 ((~~Historic~~)) Landmark buildings. ((~~The provisions of this code that require improvements relative to a building's existing condition or, in the case of *repairs*, that require improvements relative to a building's predamage condition, shall not be mandatory for *historic buildings* unless specifically required by this section.~~)) Landmark buildings shall comply with Section 310.

((~~**507.2 Life safety hazards.** The provisions of this code shall apply to *historic buildings* judged by the *code official* to constitute a distinct life safety hazard.~~

~~**[BS] 507.3 Flood hazard areas.** Within *flood hazard areas* established in accordance with Section 1612.3 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable, where the work proposed constitutes *substantial improvement*, the building shall be brought into compliance with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~**Exception:** *Historic buildings* meeting any of the following criteria need not be brought into compliance:~~

~~1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.~~

2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

[BS] 507.4 Structural. *Historic buildings* shall comply with the applicable structural provisions in this chapter.

Exceptions:

1. The *code official* shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. *Repair* of *substantial structural damage* is not required to comply with Sections 405.2.3, and 405.2.4. *Substantial structural damage* shall be repaired in accordance with Section 405.2.1.))

CHAPTER 6
CLASSIFICATION OF WORK

User note:

About this chapter: *Chapter 6 provides an overview of the Work Area Method available as an option for rehabilitation of a building. The chapter defines the different classifications of alterations and provides general requirements for alterations, change of occupancy, additions and historic buildings. Detailed requirements for all of these are given in Chapters 7 through 12.*

SECTION 601
GENERAL

[S] 601.1 Scope. The provisions of this chapter shall be used in conjunction with Chapters 7 through ((~~12~~)) 11 and 14 and shall apply to the *alteration*, *addition* and *change of occupancy* of *existing structures*. ((~~, including historic and moved structures, as referenced in Section 301.3.2.~~)) The work performed on an *existing building* shall be classified in accordance with this chapter.

Note: All alterations, additions and changes of occupancy are required to comply with Chapter 3.

[S] 601.1.1 Compliance with other alternatives. *Alterations*, *additions* and *changes of occupancy* to *existing structures* shall comply with the provisions of Chapters 3 and 7 through ((~~12~~)) 11 or with one of the alternatives provided in Section 301.3.

601.2 Work area. The *work area*, as defined in Chapter 2, shall be identified on the construction documents.

SECTION 602
ALTERATION—LEVEL 1

602.1 Scope. Level 1 alterations include the removal and replacement or the covering of existing materials, elements, *equipment* or *fixtures* using new materials, elements, *equipment* or *fixtures* that serve the same purpose.

602.2 Application. Level 1 *alterations* shall comply with the provisions of Chapter 7.

SECTION 603
ALTERATION—LEVEL 2

[W] 603.1 Scope. Level 2 *alterations* include the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment, and shall apply where the w*ork* ((~~*area* is equal to or less than 50 percent of the building area~~)) is below the threshold of a Level 3 alteration.

Exception: The movement or addition of nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height shall not be considered a Level 2 *alteration*.

603.2 Application. Level 2 *alterations* shall comply with the provisions of Chapter 7 for Level 1 *alterations* as well as the provisions of Chapter 8.

SECTION 604
ALTERATION—LEVEL 3

604.1 Scope. Level 3 *alterations* apply where the *work area* exceeds 50 percent of the *building area*.

604.2 Application. Level 3 *alterations* shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 *alterations*, respectively, as well as the provisions of Chapter 9.

SECTION 605
CHANGE OF OCCUPANCY

605.1 Scope. *Change of occupancy* provisions apply where the activity is classified as a *change of occupancy* as defined in Chapter 2.

605.2 Application. *Changes of occupancy* shall comply with the provisions of Chapter 10.

SECTION 606
ADDITIONS

606.1 Scope. Provisions for *additions* shall apply where work is classified as an *addition* as defined in Chapter 2.

606.2 Application. *Additions* to *existing buildings* shall comply with the provisions of Chapter 11.

[S] SECTION 607
((~~HISTORIC BUILDINGS~~)) LANDMARKS

[S] 607.1 Scope. ((~~*Historic building* provisions~~)) *Landmarks* shall ((~~apply to buildings classified as historic as defined in Chapter 2~~)) comply with the provisions of Section 310.

[S] ((~~607.2 Application.~~ ~~Except as specifically provided for in Chapter 12, *historic buildings* shall comply with applicable provisions of this code for the type of work being performed.~~))

CHAPTER 7
ALTERATIONS—LEVEL 1

User note:

About this chapter: *Chapter 7 provides the technical requirements for those existing buildings that undergo Level 1 alterations as described in Section 603, which includes replacement or covering of existing materials, elements, equipment or fixtures using new materials for the same purpose. This chapter, similar to other chapters of this code, covers all building-related subjects, such as structural, mechanical, plumbing, electrical and accessibility as well as the fire and life safety issues when the alterations are classified as Level 1. The purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system. This chapter is distinguished from Chapters 8 and 9 by involving only replacement of building components with new components. In contrast, Level 2 alterations involve more space reconfiguration, and Level 3 alterations involve more extensive space reconfiguration, exceeding 50 percent of the building area.*

SECTION 701
GENERAL

[S] 701.1 Scope. Level 1 *alterations* as described in Section 602 shall comply with the requirements of this chapter. ((~~Level 1 *alterations* to *historic buildings* shall comply with this chapter, except as modified in Chapter 12.~~))

701.2 Conformance. An *existing building* or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered shall conform to the requirements of the *International Building Code*.

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SECTION 702
BUILDING ELEMENTS AND MATERIALS

702.1 Interior finishes. Newly installed interior wall and ceiling finishes shall comply with Chapter 8 of the *International Building Code*.

702.2 Interior floor finish. New interior floor finish, including new carpeting used as an interior floor finish material, shall comply with Section 804 of the *International Building Code*.

702.3 Interior trim. Newly installed interior trim materials shall comply with Section 806 of the *International Building Code*.

[S] 702.4 Window opening control devices on replacement windows. In Group R-2 or R-3 buildings containing dwelling units, ((~~and one- and two-family dwellings and townhouses regulated by the *International Residential Code*,~~)) window opening control devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
   2.1. The window replacement includes replacement of the sash and frame.
   2.2. The window replacement includes the sash only where the existing frame remains.

((~~3. One of the following applies:~~

~~3.1~~)) 3. In Group R-2 or R-3 buildings containing dwelling units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.

((~~3.2. In one- and two-family dwellings and townhouses regulated by the *International Residential Code*, the bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.~~))

4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.
5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the **bottom** of the **clear opening** of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2006.

[S] 702.5 Replacement window for emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings* in Group R-2 and R-3 occupancies, ((~~and one- and two-family dwellings and townhouses regulated by the *International Residential Code*,~~)) replacement windows shall be exempt from the requirements of Section 1031.3 of the *International Building Code*, ((~~and Section R310.2 of the *International Residential Code*,~~)) provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening.
2. Where the replacement window is part of a *change of occupancy* it shall comply with Section 1011.5.6.

702.5.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings.* After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys or tools.

702.6 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:

1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the emergency escape and rescue openings.
4. Smoke alarms shall be installed in accordance with Section 907.2.11 of the *International Building Code*.

[W][S] 702.7 Materials and methods. New work shall comply with the materials and methods requirements in the *International Building Code*, ((~~*International*~~)) *Seattle Energy* ((~~*Conservation*~~)) *Code*, *International Mechanical Code* and ((~~*International*~~)) *Uniform Plumbing Code*, as applicable, that specify material standards, detail of installation and connection, joints, penetrations and continuity of any element, component or system in the building.

[FG] 702.7.1 International Fuel Gas Code. The following sections of the *International Fuel Gas Code* shall constitute the fuel gas materials and methods requirements for Level 1 *alterations*.

1. Chapter 3, entitled "General Regulations," except Sections 303.7 and 306.
2. Chapter 4, entitled "Gas Piping Installations," except Sections 401.8 and 402.3.
   2.1. Sections 401.8 and 402.3 shall apply where the work being performed increases the load on the system such that the existing pipe does not meet the size required by code. Existing systems that are modified shall not require resizing as long as the load on the system is not increased and the system length is not increased even if the altered system does not meet code minimums.
3. Chapter 5, entitled "Chimneys and Vents."
4. Chapter 6, entitled "Specific Appliances."

SECTION 703
FIRE PROTECTION

703.1 General. *Alterations* shall be done in a manner that maintains the level of fire protection provided.

SECTION 704
MEANS OF EGRESS

704.1 General. *Alterations* shall be done in a manner that maintains the level of protection provided for the means of egress.

704.1.1 Projections in nursing home corridors. In Group I-2, Condition 1 occupancies, where the corridor is at least 96 inches (2438 mm) wide, projections into the corridor width are permitted in accordance with Section 407.4.3 of the *International Building Code*.

704.2 Casework. Addition, alteration or reconfiguration of nonfixed and movable cases, counters and partitions not over 5 feet 9 inches (1753 mm) in height shall maintain the required means of egress path.

704.3 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the *International Building Code*.

[S] ((~~SECTION 706~~ ~~STRUCTURAL~~ *

~~**[BS] 706.1 General.** Where *alteration* work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the provisions of this section shall apply.~~

~~**[BS] 706.2 Addition or replacement of roofing or replacement of equipment.** Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *International Building Code* for new structures.~~

~~**Exceptions:**~~

1. ~~Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.~~
2. ~~Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing single layer of roof covering.~~

~~**[BS] 706.3 Additional requirements for reroof permits.** The requirements of this section shall apply to *alteration* work requiring reroof permits.~~

~~**[BS] 706.3.1 Bracing for unreinforced masonry bearing wall parapets.** Where a permit is issued for reroofing for more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall include installation of parapet bracing unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.~~

~~**[BS] 706.3.2 Roof diaphragms resisting wind loads in high-wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the ultimate design wind speed, V_{ult}, determined in accordance with Figure 1609.3(1) of the *International Building Code*, is greater than 130 mph (58 m/s), roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the *International Building Code*.~~

~~**Exception:** Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7-88 or later editions.~~))

[S] SECTION ((~~707~~)) 705 ELECTRICAL

[S] ((~~707.1~~)) 705.1 Health care facilities. In Group I-2 facilities, ambulatory care facilities and outpatient clinics, any altered portion of an existing electrical systems shall be required to meet installation and equipment requirements in the *Seattle Electrical Code* and NFPA 99 for medical gas systems.

[S] ((~~SECTION 708~~ ~~ENERGY CONSERVATION~~

~~**708.1 Minimum requirements.** Level 1 *alterations* to *existing buildings* or structures do not require the entire building or structure to comply with the energy requirements of the *International Energy Conservation Code* or *International Residential Code*. The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.~~))

CHAPTER 8
ALTERATIONS—LEVEL 2

User note:

About this chapter: *Like Chapter 7, the purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system when a building is being altered. This chapter is distinguished from Chapters 7 and 9 by involving space reconfiguration that could be up to and including 50 percent of the area of the building. In contrast, Level 1 alterations (Chapter 7) do not involve space reconfiguration, and Level 3 alterations (Chapter 9) involve extensive space reconfiguration that exceeds 50 percent of the building area. Depending on the nature of alteration work, its location within the building, and whether it encompasses one or more tenants, improvements and upgrades could be required for the open floor penetrations, sprinkler system or the installation of additional means of egress such as stairs or fire escapes.*

SECTION 801
GENERAL

801.1 Scope. Level 2 *alterations* as described in Section 603 shall comply with the requirements of this chapter.

Exception: Buildings in which the reconfiguration is exclusively the result of compliance with the accessibility requirements of Section 306.7.1 shall be permitted to comply with Chapter 7.

801.2 Alteration Level 1 compliance. In addition to the requirements of this chapter, all work shall comply with the requirements of Chapter 7.

[S] ((~~801.3 System installations.~~ ~~Requirements related to *work area* are not applicable where the Level 2 *alterations* are limited solely to one or more of the following:~~

~~1. Mechanical systems, electrical systems, fire protection systems and abatement of hazardous materials.~~

~~2. Windows, hardware, operating controls, electrical outlets and signs.~~

~~3. *Alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.~~))

[S] 801.4 Compliance. New construction elements, components, systems and spaces shall comply with the requirements of the *International Building Code*.

Exceptions:

1. Where windows are added they are not required to comply with the light and ventilation requirements of the *International Building Code*.

((~~2. Newly installed electrical equipment shall comply with the requirements of Section 806.~~

~~3~~)) 2. The length of dead-end corridors in newly constructed spaces shall only be required to comply with the provisions of Section 804.7.

((~~4~~)) 3. The minimum ceiling height of the newly created habitable and occupiable spaces and corridors shall be 7 feet (2134 mm).

((~~5~~)) 4. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of no less than 32 inches (815 mm).

((~~6~~)) 5. New structural members and connections shall be permitted to comply with alternative design criteria in accordance with Section 302.

6. Automatic sprinkler systems are required when new dwelling units are added to buildings according to Items 6.1 through 6.6 below. This exception is permitted to be used to add one unit after October 29, 1990.

   6.1. One unit is permitted to be added to a residential or commercial building without an automatic sprinkler system unless sprinklers are otherwise required by this section. If more than one unit is added, the new units shall be equipped with a sprinkler system.

   6.2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the unit is added, an automatic sprinkler system shall be provided in the new unit. The addition of the new unit shall not be allowed if it increases the nonconformity.

   6.3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.

   6.4. One unit is permitted to be added to an existing duplex without an automatic sprinkler system where both of the following conditions are met:

6.4.1. The project is considered a *substantial alteration* only because of the change in occupancy; and

6.4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.

6.5. Where one unit is added to an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:

6.5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;

6.5.2. The project is considered a *substantial alteration* only because of the change in occupancy;

6.5.3. The new unit is constructed as an addition to the duplex;

6.5.4. The new unit is separated from the existing duplex by a fire wall; and

6.5.5. The addition by itself complies with the requirements for a Group R-2 occupancy.

6.6. A sprinkler system is not required when a Group U occupancy that is accessory to a Group R-3 occupancy is converted to a dwelling unit.

7. Ceilings in basements are permitted to project to within 6 feet 8 inches (2032 mm) of the finished floor, and beams, girders, ducts or other obstructions are permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor.

8. Ceiling height in buildings in existence prior to October 17, 1979, shall be permitted to comply with rules promulgated by the *code official*.

SECTION 802
BUILDING ELEMENTS AND MATERIALS

802.1 Scope. The requirements of this section are limited to *work areas* in which Level 2 *alterations* are being performed and shall apply beyond the *work area* where specified.

802.2 Vertical openings. Existing vertical openings shall comply with the provisions of Sections 802.2.1, 802.2.2 and 802.2.3.

[S] 802.2.1 Existing vertical openings. Existing interior vertical openings connecting two or more floors shall be enclosed with *approved* assemblies having a fire-resistance rating of not less than 1 hour with *approved* opening protectives.

Exceptions:

1. Where vertical opening enclosure is not required by the *International Building Code* or the *International Fire Code*.
2. Interior vertical openings other than stairways may be blocked at the floor and ceiling of the *work area* by installation of not less than 2 inches (51 mm) of solid wood or equivalent construction.
3. The enclosure shall not be required where:
   3.1. Connecting the main floor and mezzanines; or
   3.2. All of the following conditions are met:
      3.2.1. The communicating area has a low-hazard occupancy or has a moderate-hazard occupancy that is protected throughout by an automatic sprinkler system.
      3.2.2. The lowest or next-to-the-lowest level is a street floor.
      3.2.3. The entire area is open and unobstructed in a manner such that it is reasonable to assume that a fire in any part of the interconnected spaces will be readily obvious to all of the occupants.
      3.2.4. Exit capacity is sufficient to provide egress simultaneously for all occupants of all levels by considering all areas to be a single floor area for the determination of required exit capacity.
      3.2.5. Each floor level, considered separately, has not less than one-half of its individual required exit capacity provided by an exit or exits leading directly out of that level without having to traverse another communicating floor level or be exposed to the smoke or fire spreading from another communicating floor level.
4. In Group A occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories.
5. In Group B occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:
   5.1. Buildings not exceeding 3,000 square feet (279 m^2) per floor.

5.2. Buildings protected throughout by an *approved* automatic fire sprinkler system.

6. In Group E occupancies, the enclosure shall not be required for vertical openings not exceeding three stories where the building is protected throughout by an *approved* automatic fire sprinkler system.

7. In Group F occupancies, the enclosure shall not be required in the following locations:

7.1. Vertical openings not exceeding three stories.

7.2. Special-purpose occupancies where necessary for manufacturing operations and direct access is provided to not fewer than one protected stairway.

7.3. Buildings protected throughout by an *approved* automatic sprinkler system.

8. In Group H occupancies, the enclosure shall not be required for vertical openings not exceeding three stories where necessary for manufacturing operations and every floor level has direct access to not fewer than two remote enclosed stairways or other *approved* exits.

9. In Group M occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:

9.1. Openings connecting only two floor levels.

9.2. Occupancies protected throughout by an *approved* automatic sprinkler system.

10. In Group R-1 occupancies, the enclosure shall not be required for vertical openings not exceeding three stories in ((~~the following locations: 10.1. Buildings~~)) buildings protected throughout by an *approved* automatic sprinkler system.

((~~10.2. Buildings with less than 25 dwelling units or sleeping units where every sleeping room above the second floor is provided with direct access to a fire escape or other *approved* second exit by means of an *approved* exterior door or window having a sill height of not greater than 44 inches (1118 mm) and where both of the following conditions are met:~~

~~10.2.1. Any exit access corridor exceeding 8 feet (2438 mm) in length that serves two means of egress, one of which is an unprotected vertical opening, shall have not fewer than one of the means of egress separated from the vertical opening by a 1-hour fire barrier.~~

~~10.2.2. The building is protected throughout by an automatic fire alarm system, installed and supervised in accordance with the *International Building Code*.~~))

11. In Group R-2 occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:

11.1. Vertical openings not exceeding two stories with not more than four dwelling units per floor.

11.2. Buildings protected throughout by an *approved* automatic sprinkler system.

((~~11.3. Buildings with not more than four dwelling units per floor where every sleeping room above the second floor is provided with direct access to a fire escape or other *approved* second exit by means of an *approved* exterior door or window having a sill height of not greater than 44 inches (1118 mm) and the building is protected throughout by an automatic fire alarm system complying with Section 803.4.~~

~~12. One- and two-family dwellings.~~

~~13~~)) 12. Group S occupancies where connecting not more than two floor levels or where connecting not more than three floor levels and the structure is equipped throughout with an *approved* automatic sprinkler system.

((~~14~~)) 13. Group S occupancies where vertical opening protection is not required for open parking garages and ramps.

802.2.2 Supplemental shaft and floor opening enclosure requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, the enclosure requirements of Section 802.2 shall apply to vertical openings other than stairways throughout the floor.

Exception: Vertical openings located in tenant spaces that are entirely outside the *work area*.

802.2.3 Supplemental stairway enclosure requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, stairways that are part of the means of egress serving the *work area* shall, at a minimum, be enclosed with smoketight construction on the highest *work area* floor and all floors below.

Exception: Where stairway enclosure is not required by the *International Building Code* or the *International Fire Code*.

802.3 Smoke compartments. In Group I-2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the *International Building Code* as required for new construction.

802.4 Interior finish. The interior finish and trim of walls and ceilings in exits and corridors in any *work area* shall comply with the requirements of the *International Building Code*.

Exception: Existing materials that do not comply with the requirements of the *International Building Code* shall be permitted to be treated with an approved fire-retardant coating in accordance with the manufacturer's instructions to achieve the required classification. Compliance with this section shall be demonstrated by testing the fire-retardant coating on the same material and achieving the required performance. Where the same material is not available, testing on a similar material shall be permitted.

802.4.1 Supplemental interior finish requirements. Where the *work area* on any floor exceeds 50 percent of the floor area, Section 802.4 shall apply to the interior finish and trim in exits and corridors serving the *work area* throughout the floor.

Exception: Interior finish within tenant spaces that are entirely outside the *work area*.

802.5 Guards. The requirements of Sections 802.5.1 and 802.5.2 shall apply in all *work areas*.

802.5.1 Minimum requirement. Every portion of a floor, such as a balcony or a loading dock, that is more than 30 inches (762 mm) above the floor or grade below and is not provided with guards, or those in which the existing guards are judged to be in danger of collapsing, shall be provided with guards.

802.5.2 Design. Where there are no guards or where existing guards must be replaced, the guards shall be designed and installed in accordance with the *International Building Code*.

802.6 Fire-resistance ratings. Where *approved* by the *code official*, buildings where an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code* has been added, and the building is now sprinklered throughout, the required fire-resistance ratings of building elements and materials shall be permitted to meet the requirements of the current building code. The building is required to meet the other applicable requirements of the *International Building Code*.

Plans, investigation and evaluation reports, and other data shall be submitted indicating which building elements and materials the applicant is requesting the *code official* to review and approve for determination of applying the current building code fire-resistance ratings. Any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means-of-egress conditions, fire code deficiencies, *approved* modifications or *approved* alternative materials, design and methods of construction, and equipment applying to the building that impact required fire-resistance ratings shall be identified in the evaluation reports submitted.

SECTION 803
FIRE PROTECTION

[S] 803.1 Scope. The requirements of this section shall be limited to *work areas* in which Level 2 *alterations* are being performed, and where specified they shall apply throughout the floor on which the *work areas* are located or otherwise beyond the *work area*.

Exception: The fire *code official* may modify or waive the fire protection requirements for Level 2 *alteration* projects in which the fire protection requirements constitute an excessive burden.

803.1.1 Corridor ratings. Where an *approved* automatic sprinkler system is installed throughout the story, the required fire-resistance rating for any corridor located on the story shall be permitted to be reduced in accordance with the *International Building Code*. In order to be considered for a corridor rating reduction, such system shall provide coverage for the stairway landings serving the floor and the intermediate landings immediately below.

803.2 Automatic sprinkler systems. Automatic sprinkler systems shall be provided in accordance with the requirements of Sections 803.2.1 through 803.2.6. Installation requirements shall be in accordance with the *International Building Code*.

803.2.1 High-rise buildings. In high-rise buildings, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection in the entire *work area* where the *work area* is located on a floor that has a sufficient sprinkler water supply system from an existing standpipe or a sprinkler riser serving that floor.

803.2.1.1 Supplemental automatic sprinkler system requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, Section 803.2.1 shall apply to the entire floor on which the *work area* is located.

Exception: Occupied tenant spaces that are entirely outside the *work area*.

[S] 803.2.2 Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, ((~~R-4,~~)) S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, ((~~R-4,~~)) S-1 and S-2, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where both of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* as applicable to new construction.
2. The *work area* exceeds 50 percent of the floor area.

Exception: If the building does not have sufficient municipal water supply for design of a fire sprinkler system available to the floor without installation of a new fire pump, *work areas* shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the *International Building Code*.

803.2.2.1 Mixed uses. In *work areas* containing mixed uses, one or more of which requires automatic sprinkler protection in accordance with Section 803.2.2, such protection shall not be required throughout the *work area* provided that the uses requiring such protection are separated from those not requiring protection by fire-resistance-rated construction having a minimum 2-hour rating for Group H and a minimum 1-hour rating for all other occupancy groups.

803.2.3 Group I-2. In Group I-2 occupancies, an automatic sprinkler system installed in accordance with Section 903.3.1.1 of the *International Fire Code* shall be provided in the following

1. In Group I-2, Condition 1, throughout the *work area*.
2. In Group I-2, Condition 2, throughout the *work area* where the *work area* is 50 percent or less of the smoke compartment.
3. In Group I-2, Condition 2, throughout the smoke compartment in which the work occurs where the *work area* exceeds 50 percent of the smoke compartment.

803.2.4 Windowless stories. Work located in a windowless story, as determined in accordance with the *International Building Code*, shall be sprinklered where the *work area* is required to be sprinklered under the provisions of the *International Building Code* for newly constructed buildings and the building has a sufficient municipal water supply without installation of a new fire pump.

803.2.5 Other required automatic sprinkler systems. In buildings and areas listed in Table 903.2.11.6 of the *International Building Code*, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with an automatic sprinkler system under the following conditions

1. The *work area* is required to be provided with an automatic sprinkler system in accordance with the *International Building Code* applicable to new construction; and
2. The building has sufficient municipal water supply for design of an automatic sprinkler system available to the floor without installation of a new fire pump.

803.2.6 Supervision. Fire sprinkler systems required by this section shall be supervised by one of the following methods:

1. *Approved* central station system in accordance with NFPA 72.
2. *Approved* proprietary system in accordance with NFPA 72.
3. *Approved* remote station system of the jurisdiction in accordance with NFPA 72.
4. Where *approved* by the *code official*, *approved* local alarm service that will cause the sounding of an alarm in accordance with NFPA 72.

Exception: Supervision is not required for the following:

1. Underground key or hub gate valves in roadway boxes.
2. Halogenated extinguishing systems.
3. Carbon dioxide extinguishing systems.
4. Dry- and wet-chemical extinguishing systems.
5. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic and automatic sprinkler systems and a separate shutoff valve for the automatic sprinkler system is not provided.

803.3 Standpipes. Where the *work area* includes exits or corridors shared by more than one tenant and is located more than 50 feet (15 240 mm) above or below the lowest level of fire department access, a standpipe system shall be provided. Standpipes shall have an *approved* fire department connection with hose connections at each floor level above or below the lowest level of fire department access. Standpipe systems shall be installed in accordance with the *International Building Code*.

Exceptions:

1. A pump shall not be required provided that the standpipes are capable of accepting delivery by fire department apparatus of not less than 250 gallons per minute (gpm) at 65 pounds per square inch (psi) (946 L/m at 448 KPa) to the topmost floor in buildings equipped throughout with an automatic sprinkler system or not less than 500 gpm at

804.4 Number of exits. The number of exits shall be in accordance with Sections 804.4.1 through 804.4.3.

804.4.1 Minimum number. Every story utilized for human occupancy on which there is a *work area* that includes exits or corridors shared by more than one tenant within the *work area* shall be provided with the minimum number of exits based on the occupancy and the occupant load in accordance with the *International Building Code*. In addition, the exits shall comply with Sections 804.4.1.1 and 804.4.1.2.

[S] 804.4.1.1 Single-exit buildings. A single exit or access to a single exit shall be permitted from spaces, any story or any occupied roof where one of the following conditions exists:

1. The occupant load, number of dwelling units and exit access travel distance do not exceed the values in Table 804.4.1.1(1) or Table 804.4.1.1(2).
2. In Group R-1 or R-2, buildings without an *approved* automatic sprinkler system, individual single-story or multiple-story dwelling or sleeping units shall be permitted to have a single exit or access to a single exit from the dwelling or sleeping unit provided one of the following criteria are met:
   2.1. The occupant load is not greater than 10 and the exit access travel distance within the unit does not exceed 75 feet (22 860 mm).
   2.2. The building is not more than three stories in height; all third-story space is part of dwelling with an exit access doorway on the second story; and the portion of the exit access travel distance from the door to any habitable room within any such unit to the unit entrance doors does not exceed 50 feet (15 240 mm).
3. In buildings of Group R-2 occupancy of any number of stories with not more than four dwelling units per floor served by an interior exit stairway; with a smokeproof enclosure in accordance with Sections 909.20 and 1023.12 of the *International Building Code* or an exterior stairway as an exit; and where the portion of the exit access travel distance from the dwelling unit entrance door to the exit is not greater than 20 feet (6096 mm).
4. In Group R-2 and R-3 occupancies, one means of egress is permitted within and from individual dwelling units with a maximum occupant load of 20 where the dwelling unit is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code*.

TABLE 804.4.1.1(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet)
Basement, first or second story above grade plane	R-2[a]	4 dwelling units	50
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Group R-2, without an approved automatic sprinkler system and provided with emergency escape and rescue openings in accordance with Section 1031 of the *International Building Code*.

TABLE 804.4.1.1(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet)
First story above or below grade plane	B, F-2, S-2[a]	35	75
Second story above grade plane	B, F-2, S-2[a]	35	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

[S] 804.4.1.2 Fire escapes. ((~~required.~~ ~~For other than Group I-2, where more than one exit is required, an existing or newly constructed fire escape complying with Section 804.4.1.2.1 shall be accepted as providing one of the required means of egress.~~)) Fire escapes that are altered shall comply with this section. Existing fire escapes shall continue to be accepted as a component in the means of egress in *existing buildings* only.

[S] ((~~804.4.1.2.1 Fire escape access and details.~~ ~~Fire escapes shall comply with all of the following requirements:~~

~~1. Occupants shall have unobstructed access to the fire escape without having to pass through a room subject to locking.~~

~~2. Access to a new fire escape shall be through a door, except that windows shall be permitted to provide access from single dwelling units or sleeping units in Group R-1, R-2 and I-1 occupancies or to provide access from spaces having a maximum occupant load of 10 in other occupancy classifications.~~

~~2.1. The window shall have a minimum net clear opening of 5.7 square feet (0.53 m^2) or 5 square feet (0.46 m^2) where located at grade.~~

~~2.2. The minimum net clear opening height shall be 24 inches (610 mm) and net clear opening width shall be 20 inches (508 mm).~~

~~2.3. The bottom of the clear opening shall not be greater than 44 inches (1118 mm) above the floor.~~

~~2.4. The operation of the window shall comply with the operational constraints of the *International Building Code*.~~

~~3. Newly constructed fire escapes shall be permitted only where exterior stairways cannot be utilized because of lot lines limiting the stairway size or because of the sidewalks, alleys, or roads at grade level.~~

~~4. Openings within 10 feet (3048 mm) of fire escape stairways shall be protected by fire assemblies having minimum 3/4-hour fire-resistance ratings.~~

~~**Exception:** Opening protection shall not be required in buildings equipped throughout with an *approved* automatic sprinkler system.~~

~~5. In all buildings of Group E occupancy, up to and including the 12th grade, buildings of Group I occupancy, rooming houses and childcare centers, ladders of any type are prohibited on fire escapes used as a required means of egress.~~))

[S] 804.4.1.2.1 Location. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall be not less than 8 feet (2438 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall be not less than 12 feet (3658 mm).

[S] 804.4.1.2.2 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other *approved noncombustible materials*. ((~~Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Types III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.~~))

804.4.1.2.3 Dimensions. Stairways shall be not less than 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm). Landings at the foot of stairways shall be not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long and located not more than 8 inches (203 mm) below the door.

[S] 804.4.1.2.4 Opening protectives. Doors and windows along the fire escape shall be protected with 3/4-hour opening protectives.

804.4.2 Mezzanines. Mezzanines in the *work area* and with an occupant load of more than 50 or in which the travel distance to an exit exceeds 75 feet (22 860 mm) shall have access to not fewer than two independent means of egress.

Exception: Two independent means of egress are not required where the travel distance to an exit does not exceed 100 feet (30 480 mm) and the building is protected throughout with an automatic sprinkler system.

804.4.3 Main entrance—Group A. Buildings of Group A with an occupant load of 300 or more shall be provided with a main entrance capable of serving as the main exit with an egress capacity of not less than one-half of the total occupant load. The remaining exits shall be capable of providing one-half of the total required exit capacity.

Exception: Where a main exit is not well defined or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.

804.5 Egress doorways. Egress doorways in any *work area* shall comply with Sections 804.5.1 through 804.5.5.

804.5.1 Two egress doorways required. Work areas shall be provided with two egress doorways in accordance with the requirements of Sections 804.5.1.1 and 804.5.1.2.

804.5.1.1 Occupant load and travel distance. In any *work area*, all rooms and spaces having an occupant load greater than 50 or in which the travel distance to an exit exceeds 75 feet (22 860 mm) shall have not fewer than two egress doorways.

Exceptions:

1. Storage rooms having a maximum occupant load of 10.
2. Where the *work area* is served by a single exit in accordance with Section 804.4.1.1.

804.12.1 Minimum requirement. Every open portion of a stairway, landing, or balcony that is more than 30 inches (762 mm) above the floor or grade below and is not provided with guards, or those portions in which existing guards are judged to be in danger of collapsing, shall be provided with guards.

804.12.2 Design. Guards required in accordance with Section 804.12.1 shall be designed and installed in accordance with the *International Building Code*.

SECTION 805
STRUCTURAL

[S][BS] 805.1 General. Structural elements and systems within buildings undergoing Level 2 *alterations* shall comply with ((~~this section~~)) Section 304. *

[S] ((~~SECTION 806~~
~~ELECTRICAL~~

~~**806.1 New installations.** Newly installed electrical equipment and wiring relating to work done in any *work area* shall comply with all applicable requirements of NFPA 70 except as provided for in Section 806.4.~~

~~**806.2 Existing installations.** Existing wiring in all *work areas* in Group A-1, A-2, A-5, H and I occupancies shall be upgraded to meet the materials and methods requirements of Chapter 7.~~

~~**806.3 Health care facilities.** In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any added portion of an existing electrical system shall be required to meet installation and equipment requirements in NFPA 99.~~

~~**806.4 Residential occupancies.** In Group R-2, R-3 and R-4 occupancies and buildings regulated by the *International Residential Code*, the requirements of Sections 806.4.1 through 806.4.7 shall be applicable only to *work areas* located within a dwelling unit.~~

~~**806.4.1 Enclosed areas.** Enclosed areas, other than closets, kitchens, basements, garages, hallways, laundry areas, utility areas, storage areas and bathrooms shall have not fewer than two duplex receptacle outlets or one duplex receptacle outlet and one ceiling or wall-type lighting outlet.~~

~~**806.4.2 Kitchens.** Kitchen areas shall have not fewer than two duplex receptacle outlets.~~

~~**806.4.3 Laundry areas.** Laundry areas shall have not fewer than one duplex receptacle outlet located near the laundry equipment and installed on an independent circuit.~~

~~**806.4.4 Ground-fault circuit interruption.** Newly installed receptacle outlets shall be provided with ground-fault circuit interruption as required by NFPA 70.~~

~~**806.4.5 Minimum lighting outlets.** Not fewer than one lighting outlet shall be provided in every bathroom, hallway, stairway, attached garage and detached garage with electric power, and to illuminate outdoor entrances and exits.~~

~~**806.4.6 Utility rooms and basements.** Not fewer than one lighting outlet shall be provided in utility rooms and basements where such spaces are used for storage or contain equipment requiring service.~~

~~**806.4.7 Clearance for equipment.** Clearance for electrical service equipment shall be provided in accordance with NFPA 70.~~))

SECTION 807
MECHANICAL

[S] ((~~807.1 Reconfigured or converted spaces.~~ ~~Reconfigured spaces intended for occupancy and spaces converted to habitable or occupiable space in any *work area* shall be provided with natural or mechanical ventilation in accordance with the *International Mechanical Code*.~~

~~**Exception:** Existing mechanical ventilation systems shall comply with the requirements of Section 807.2.~~))

807.1 Mechanical systems. Mechanical systems shall comply with the *International Mechanical Code*.

[S] ((~~807.2 Altered existing systems.~~ ~~In mechanically ventilated spaces, existing mechanical ventilation systems that are altered, reconfigured or extended shall provide not less than 5 cubic feet per minute (cfm) (0.0024 m^3/s) per person of outdoor air and not less than 15 cfm (0.0071 m^3/s) of ventilation air per person, or not less than the amount of ventilation air determined by the Indoor Air Quality Procedure of ASHRAE 62.1.~~))

[S] ((~~807.3 Local exhaust.~~ ~~Newly introduced devices, equipment or operations that produce airborne particulate matter, odors, fumes, vapor, combustion products, gaseous contaminants, pathogenic and allergenic organisms, and microbial contaminants~~

~~in such quantities as to affect adversely or impair health or cause discomfort to occupants shall be provided with local exhaust.~~))

SECTION 808
PLUMBING

* **808.1 Health care facilities.** In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any added portion of an existing medical gas system shall be required to meet installation and equipment requirements in NFPA 99.

[S] ((~~SECTION 809~~
~~ENERGY CONSERVATION~~

~~**809.1 Minimum requirements.** Level 2 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *International Energy Conservation Code* or *International Residential Code*. The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.~~))

CHAPTER 9
ALTERATIONS—LEVEL 3

User note:

***About this chapter**: Chapter 9 provides the technical requirements for those existing buildings that undergo Level 3 alterations. The purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system. This chapter is distinguished from Chapters 7 and 8 by involving alterations that cover 50 percent or more of the aggregate area of the building. In contrast, Level 1 alterations do not involve space reconfiguration, and Level 2 alterations involve extensive space reconfiguration that does not exceed 50 percent of the building area. Depending on the nature of alteration work, its location within the building, and whether it encompasses one or more tenants, improvements and upgrades could be required for the open floor penetrations, sprinkler system or the installation of additional means of egress such as stairs or fire escapes. At times and under certain situations, this chapter also is intended to improve the safety of certain building features beyond the work area and in other parts of the building where no alteration work might be taking place.*

SECTION 901
GENERAL

901.1 Scope. Level 3 *alterations* as described in Section 604 shall comply with the requirements of this chapter.

901.2 Compliance. In addition to the provisions of this chapter, work shall comply with all of the requirements of Chapters 7 and 8. The requirements of Sections 802, 803, 804 and 805 shall apply within all *work areas* whether or not they include exits and corridors shared by more than one tenant and regardless of the occupant load.

Exception: Buildings in which the reconfiguration of space affecting exits or shared egress access is exclusively the result of compliance with the accessibility requirements of Section 306.7.1 shall not be required to comply with this chapter.

SECTION 902
SPECIAL USE AND OCCUPANCY

[S] 902.1 High-rise buildings. Any building having occupied floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with the requirements of ((~~Sections~~)) Section 902.1.1. ((~~and 902.1.2.~~))

902.1.1 Recirculating air or exhaust systems. Where a floor is served by a recirculating air or exhaust system with a capacity greater than 15,000 cubic feet per minute (701 m^3/s), that system shall be equipped with *approved* smoke and heat detection devices installed in accordance with the *International Mechanical Code*.

((~~**902.1.2 Elevators.** Where there is an elevator or elevators for public use, not fewer than one elevator serving the *work area* shall comply with this section. Existing elevators with a travel distance of 25 feet (7620 mm) or more above or below the main floor or other level of a building and intended to serve the needs of emergency personnel for fire fighting or rescue purposes shall be provided with emergency operation in accordance with ASME A17.3. New elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with ASME A17.1/CSA B44.1.~~))

[S] 902.2 Boiler and furnace equipment rooms. Boiler and furnace equipment rooms adjacent to or within Group I-1, I-2, I-4, R-1, and R-2 ((~~and R-4~~)) occupancies shall be enclosed by 1-hour fire-resistance-rated construction.

Exceptions:

1. Steam boiler equipment operating at pressures of 15 pounds per square inch gauge (psig) (103.4 kPa) or less is not required to be enclosed.
2. Hot water boilers operating at pressures of 170 psig (1171 kPa) or less are not required to be enclosed.
3. Furnace and boiler equipment with 400,000 British thermal units (Btu) (4.22 × 108 J) per hour input rating or less is not required to be enclosed.
4. Furnace rooms protected with an automatic sprinkler system are not required to be enclosed.

SECTION 903
BUILDING ELEMENTS AND MATERIALS

903.1 Existing shafts and vertical openings. Existing stairways that are part of the means of egress shall be enclosed in accordance with Section 802.2.1 from the highest *work area* floor to, and including, the level of exit discharge and all floors below.

903.2 Fire partitions in Group R-3. Fire separation in Group R-3 occupancies shall be in accordance with Section 903.2.1.

[S] 903.2.1 Separation required. Where the *work area* is in any attached dwelling unit in Group R-3 or any multiple single-family dwelling (townhouse), walls separating the dwelling units that are not continuous from the foundation to the underside of the roof sheathing shall be constructed to provide a continuous fire separation using construction materials consistent with the existing wall or complying with the requirements for new structures. Work shall be performed on the side of the dwelling unit wall that is part of the *work area*.

Exception: Where *alterations* ((~~or repairs~~)) do not result in the removal of wall or ceiling finishes exposing the structure, walls are not required to be continuous through concealed floor spaces.

903.3 Interior finish. Interior finish in exits serving the *work area* shall comply with Section 802.4 between the highest floor on which there is a *work area* to the floor of exit discharge.

903.4 Enhanced classroom acoustics. In Group E occupancies, where the *work area* is a Level 3 alteration, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

SECTION 904
FIRE PROTECTION

904.1 Automatic sprinkler systems. An automatic sprinkler system shall be provided in a *work area* where required by Section 803.2 or this section.

904.1.1 High-rise buildings. An automatic sprinkler system shall be provided in *work areas* where the high-rise building has a sufficient municipal water supply for the design and installation of an automatic sprinkler system at the site.

904.1.2 Rubbish and linen chutes. Rubbish and linen chutes located in the *work area* shall be provided with automatic sprinkler system protection or an *approved* automatic fire-extinguishing system where protection of the rubbish and linen chute would be required under the provisions of the *International Building Code* for new construction.

904.1.3 Upholstered furniture or mattresses. *Work areas* shall be provided with an automatic sprinkler system in accordance with the *International Building Code* where any of the following conditions exist:

1. A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).
2. A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m^2).
3. A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).

[S] 904.1.4 Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2 work areas shall be provided with automatic sprinkler protection where all of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* as applicable to new construction.

((~~2. The building site has sufficient municipal water supply for design and installation of an automatic sprinkler system.~~

~~**Exception:** If the building site does not have sufficient municipal water supply for design of an automatic sprinkler system, work areas shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the *International Building Code*.~~))

[S] 904.1.5 Group I-2. In Group I-2 occupancies, an automatic sprinkler system installed in accordance with ((~~Section 903.3.1.1~~)) Chapter 11 of the *International Fire Code* ((~~shall be provided in the following:~~

~~1. In Group I-2, Condition 1, throughout the *work area*.~~

~~2. In Group I-2, Condition 2, throughout the *work area* where the *work area* is 50 percent or less of the smoke compartment.~~

~~3. In Group I-2, Condition 2, throughout the smoke compartment in which the work occurs where the *work area* exceeds 50 percent of the smoke compartment.~~))

[S] 904.1.6 Windowless stories. Work located in a windowless story, as determined in accordance with the *International Building Code*, shall be sprinklered where the *work area* is required to be sprinklered under the provisions of the *International Building Code* for newly constructed buildings ((~~and the building site has a sufficient municipal water supply for the design and installation of an automatic sprinkler system.~~))

904.1.7 Other required automatic sprinkler systems. In buildings and areas listed in Table 903.2.11.6 of the *International Building Code*, *work areas* shall be provided with an automatic sprinkler system under the following conditions:

1. The *work area* is required to be provided with an automatic sprinkler system in accordance with the *International Building Code* applicable to new construction.
2. The building site has sufficient municipal water supply for design and installation of an automatic sprinkler system.

904.2 Fire alarm and detection systems. Fire alarm and detection shall be provided in accordance with Section 907 of the *International Building Code* as required for new construction.

904.2.1 Manual fire alarm systems. Where required by the *International Building Code*, a manual fire alarm system shall be provided throughout the *work area*. Alarm notification appliances shall be provided on such floors and shall be automatically activated as required by the *International Building Code*.

Exceptions:

1. Alarm-initiating and notification appliances shall not be required to be installed in tenant spaces outside of the *work area*.
2. Visual alarm notification appliances are not required, except where an existing alarm system is upgraded or replaced or where a new fire alarm system is installed.

904.2.2 Automatic fire detection. Where required by the *International Building Code* for new buildings, automatic fire detection systems shall be provided throughout the *work area*.

SECTION 905
MEANS OF EGRESS

905.1 General. The means of egress shall comply with the requirements of Section 804 except as specifically required in Sections 905.2 and 905.3.

905.2 Means-of-egress lighting. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with artificial lighting within the exit enclosure in accordance with the requirements of the *International Building Code*.

905.3 Exit signs. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with exit signs in accordance with the requirements of the *International Building Code*.

905.4 Two-way communications systems. In buildings with elevator service, a two-way communication system shall be provided where required by Section 1009.8 of the *International Building Code*.

SECTION 906
STRUCTURAL

[S][BS] 906.1 General. Where buildings are undergoing Level 3 *alterations*, the provisions of ((~~this section~~)) Section 304 shall apply.

[S] ((~~[BS] 906.3 Seismic Design Category F.~~ ~~Where the building is assigned to Seismic Design Category F, the structure of the altered building shall meet the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced seismic forces shall be permitted.~~)) *

[S] ((~~[BS] 906.4 Anchorage for concrete and masonry buildings.~~ ~~For any building assigned to Seismic Design Category D, E or F with a structural system that includes concrete or reinforced masonry walls with a flexible roof diaphragm, the *alteration* work shall include installation of wall anchors at the roof line of all subject buildings and at the floor lines of unreinforced masonry buildings unless an evaluation demonstrates compliance of existing wall anchorage. Reduced seismic forces shall be permitted.~~)) *

[S] ((~~[BS] 906.6 Bracing for unreinforced masonry parapets.~~ ~~Parapets constructed of unreinforced masonry in buildings assigned to Seismic Design Category C, D, E or F shall have bracing installed as needed to resist the reduced *International Building Code* level seismic forces in accordance with Section 304.3, unless an evaluation demonstrates compliance of such items. Use of reduced seismic forces shall be permitted.~~))

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[S] ((~~SECTION 907~~
~~ENERGY CONSERVATION~~

~~907.1 Minimum requirements.~~ ~~Level 3 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *International Energy Conservation Code* or *International Residential Code*. The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.~~))

CHAPTER 10
CHANGE OF OCCUPANCY

User note:

***About this chapter**: The purpose of this chapter is to provide regulations for the circumstances where an existing building is subject to a change of occupancy or a change of occupancy classification. A change of occupancy is not to be confused with a change of occupancy classification. The* International Building Code® *defines different occupancy classifications in Chapter 3 and special occupancy requirements in Chapter 4. Within specific occupancy classifications there can be many different types of actual activities that can take place. For instance, a Group A-3 occupancy classification deals with a wide variation of different types of activities, including bowling alleys and courtrooms, indoor tennis courts and dance halls. When a facility changes use from, for example, a bowling alley to a dance hall, the occupancy classification remains A-3, but the different uses could lead to drastically different code requirements. Therefore, this chapter deals with the special circumstances that are associated with a change in the use of a building within the same occupancy classification as well as a change of occupancy classification.*

SECTION 1001
GENERAL

[S] 1001.1 Scope. The provisions of this chapter shall apply where a *change of occupancy* occurs, as defined in Section 202.

Note: The following illustrate how change of occupancy is interpreted:

- Change of occupancy classification is a change in the letter designation. An example is a change from B occupancy to R occupancy.
- Change in occupancy group is change in the number designation within an occupancy classification. An example is a change from group R-1 occupancy to R-2 occupancy.
- Change of use is a change in the subcategory within the occupancy group. An example is a change from R-2 apartment to R-2 boarding house.

When "change of occupancy" is italicized in this chapter, it is a global term meant to describe the act of changing the classification, group or use of a building or portion thereof. The terms "change in occupancy group," "change in occupancy classification" or "change in use" where the phrase "change in occupancy" is not italicized have the meanings described above.

Note: *Changes of occupancy* that are substantial alterations as determined by Section 311.1.1 are required to comply with Section 311.

[S] 1001.2 ((~~Certificate~~)) Change of occupancy. A *change of occupancy* or a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the *International Building Code* shall not be made to any structure without the approval of the *code official*. ((~~A certificate of occupancy shall be issued where it has been determined that the requirements for the *change of occupancy* have been met.~~))

[S] 1001.2.1 Change of use. Any work undertaken in connection with a change in use that does not involve a *change of occupancy* classification or a change to another group within an occupancy classification shall conform to the applicable requirements for the work as classified in Chapter 6 and to the requirements of Sections 1002 through 1010.

Exception: As modified in Section ((~~1204~~)) 310 for ((~~*historic buildings*~~)) *landmarks*.

[S] 1001.2.2 Change of occupancy classification or group. Where the occupancy classification or group of a building changes, the provisions of Sections 1002 through 1011 shall apply. This includes a change of occupancy classification and a change to another group within an occupancy classification.

1001.2.2.1 Partial change of occupancy. Where the occupancy classification or group of a portion of an *existing building* is changed, Section 1011 shall apply.

[S] 1001.3 Certificate of occupancy required. A certificate of occupancy shall be issued where a *change of occupancy* occurs that results in a different occupancy classification or group as determined by the *International Building Code*.

SECTION 1002
SPECIAL USE AND OCCUPANCY

1002.1 Compliance with the building code. Where an *existing building* or part of an *existing building* undergoes a *change of occupancy* to one of the special use or occupancy categories as described in Chapter 4 in the *International Building Code*, the

building shall comply with all of the requirements of Chapter 4 of the *International Building Code* applicable to the special use or occupancy.

1002.2 Incidental uses. Where a portion of a building undergoes a *change of occupancy* to one of the incidental uses listed in Table 509.1 of the *International Building Code*, the incidental use shall comply with Section 509 of the *International Building Code* applicable to the incidental use.

[W] 1002.3 Change of occupancy in health care. Where a *change of occupancy* occurs to a Group I-2 or I-1 *facility*, the *work area* with the *change of occupancy* shall comply with the *International Building Code*.

The *International Building Code* shall apply to Group I-1, Condition 2, for licensure as an assisted living facility under chapter 388-78A WAC or residential treatment facility under chapter 246-337 WAC.

Exception: A change in use or occupancy in the following cases shall not be required to meet the *International Building Code*:

1. Group I-2, Condition 2 to Group I-2, Condition 1.
2. Group I-2 to ambulatory health care.
3. Group I-2 to Group I-1.
4. Group I-1, Condition 2 to Group I-1, Condition 1.

1002.4 Storage. In Group I-2 occupancies, equipped throughout with an automatic sprinkler in accordance with Section 903.3.1.1 of the *International Building Code*, where a room 250 square feet (23.2 m^2) or less undergoes a change in occupancy to a storage room, the room shall be separated from the remainder of the building by construction capable of resisting the passage of smoke in accordance with Section 509.4.2 of the *International Building Code*.

SECTION 1003
BUILDING ELEMENTS AND MATERIALS

1003.1 General. Building elements and materials in portions of buildings undergoing a change of occupancy classification shall comply with Section 1011.

SECTION 1004
FIRE PROTECTION

1004.1 General. Fire protection requirements of Section 1011 shall apply where a building or portions thereof undergo a *change of occupancy* classification or where there is a change of occupancy within a space where there is a different fire protection system threshold requirement in Chapter 9 of the *International Building Code*.

SECTION 1005
MEANS OF EGRESS

1005.1 General. Means of egress in portions of buildings undergoing a change of occupancy classification shall comply with Section 1011.

SECTION 1006
STRUCTURAL

[S] ((~~[BS] 1006.1 Live loads.~~ ~~Structural elements carrying tributary live loads from an area with a *change of occupancy* shall satisfy the requirements of Section 1607 of the *International Building Code*. Design live loads for areas of new occupancy shall be based on Section 1607 of the *International Building Code*. Design live loads for other areas shall be permitted to use previously *approved* design live loads.~~

~~Exception:~~ ~~Structural elements whose demand-capacity ratio considering the *change of occupancy* is not more than 5 percent greater than the demand-capacity ratio based on previously *approved* live loads.~~))

[S] 1006.1 Structural. Buildings or portions thereof subject to a *change of occupancy* shall comply with Section 304.2.

[S] ((~~[BS] 1006.2 Snow and wind loads.~~ ~~Where a *change of occupancy* results in a structure being assigned to a higher *risk category*, the structure shall satisfy the requirements of Sections 1608 and 1609 of the *International Building Code* for the new risk category.~~

~~Exception:~~ ~~Where the area of the new occupancy is less than 10 percent of the building area. The cumulative effect of occupancy changes over time shall be considered.~~))

[S] ((~~[BS] 1006.3 Seismic loads.~~ ~~Where a *change of occupancy* results in a building being assigned to a higher *risk category*, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the building shall satisfy the requirements of Section 1613 of the *International Building Code* for the new *risk category* using full seismic forces.~~

~~Exceptions:~~

1. ~~Where a *change of use* results in a building being reclassified from *Risk Category* I or II to *Risk Category* III and the seismic coefficient, S_{DS}, is less than 0.33, compliance with this section is not required.~~
2. ~~Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to *Risk Category* IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.~~
3. ~~Unreinforced masonry bearing wall buildings assigned to *Risk Category* III and to Seismic Design Category A or B shall be permitted to use Appendix Chapter A1 of this code.~~
4. ~~Where the change is from a Group S or Group U occupancy and there is no change of *risk category*, use of reduced seismic forces shall be permitted.~~))

[S] ((~~[BS] 1006.4 Access to Risk Category IV.~~ ~~Any structure that provides operational access to an adjacent structure assigned to *Risk Category* IV as the result of a change of occupancy shall itself satisfy the requirements of Sections 1608, 1609 and 1613 of the *International Building Code*. For compliance with Section 1613 of the *International Building Code*, the full seismic forces shall be used. Where operational access to *Risk Category* IV is less than 10 feet (3048 mm) from either an interior lot line or from another structure, access protection from potential falling debris shall be provided.~~))

[S] ((~~SECTION 1007~~ ~~ELECTRICAL~~

~~1007.1 Special occupancies.~~ ~~Where the occupancy of an *existing building* or part of an *existing building* is changed to one of the following special occupancies as described in NFPA 70, the electrical wiring and equipment of the building or portion thereof that contains the proposed occupancy shall comply with the applicable requirements of NFPA 70. Health care *facilities*, including Group I-2, ambulatory health care *facilities* and outpatient clinics, shall also comply with the applicable requirements of NFPA 99:~~

1. ~~Hazardous locations.~~
2. ~~Commercial garages, repair and storage.~~
3. ~~Aircraft hangars.~~
4. ~~Gasoline dispensing and service stations.~~
5. ~~Bulk storage plants.~~
6. ~~Spray application, dipping and coating processes.~~
7. ~~Health care *facilities*, including Group I-2, ambulatory health care *facilities* and outpatient clinics.~~
8. ~~Places of assembly.~~
9. ~~Theaters, audience areas of motion picture and television studios, and similar locations.~~
10. ~~Motion picture and television studios and similar locations.~~
11. ~~Motion picture projectors.~~
12. ~~Agricultural buildings.~~

~~1007.2 Unsafe conditions.~~ ~~Where the occupancy of an *existing building* or part of an *existing building* is changed, all *unsafe* conditions shall be corrected without requiring that all parts of the electrical system comply with NFPA 70.~~

~~1007.3 Service upgrade.~~ ~~Where the occupancy of an *existing building* or part of an *existing building* is changed, electrical service shall be upgraded to meet the requirements of NFPA 70 for the new occupancy.~~

~~1007.4 Number of electrical outlets.~~ ~~Where the occupancy of an *existing building* or part of an *existing building* is changed, the number of electrical outlets shall comply with NFPA 70 for the new occupancy.~~))

SECTION 1008
MECHANICAL

[S] 1008.1 Mechanical requirements. ((~~Where the occupancy of an *existing building* or part of an *existing building* is changed such that the new occupancy is subject to different kitchen exhaust requirements or to increased mechanical ventilation requirements in accordance with the *International Mechanical Code*, the new occupancy shall comply with the respective~~

~~*International Mechanical Code* provisions.~~)) Mechanical equipment and systems shall comply with the *International Mechanical Code*.

SECTION 1009
PLUMBING

[W][S] 1009.1 Increased demand. Where ((~~the~~)) a *change of occupancy* ((~~of~~)) in an *existing building* or part of an *existing building* ((~~is changed such that the~~)) results in a new occupancy that is subject to increased or different plumbing fixture requirements or to increased water supply requirements in accordance with the *International Building Code and* ((~~*International*~~)) *Uniform Plumbing Code*, the new occupancy shall comply with the ((~~intent of the~~)) respective *International Building Code and* ((~~*International*~~)) *Uniform Plumbing Code* provisions.

** **Exception:** Only where the occupant load of the story is increased by more than 20 percent, plumbing fixtures for the story shall be provided in quantities specified in the *International* ((~~*Plumbing*~~)) *Building Code* based on the increased occupant load.

[W] 1009.2 Food-handling occupancies. If the new occupancy is a food-handling establishment, all existing sanitary waste lines above the food or drink preparation or storage areas shall be panned or otherwise protected to prevent leaking pipes or condensation on pipes from contaminating food or drink. New drainage lines shall not be installed above such areas and shall be protected in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

[W] 1009.3 Interceptor required. If the new occupancy will produce grease or oil-laden wastes, interceptors shall be provided as required in the ((~~*International*~~)) *Uniform Plumbing Code*.

1009.4 Chemical wastes. If the new occupancy will produce chemical wastes, the following shall apply:

1. If the existing piping is not compatible with the chemical waste, the waste shall be neutralized prior to entering the drainage system or the piping shall be changed to a compatible material.
2. Chemical waste shall not discharge to a public sewer system without the approval of the sewage authority.

[W] 1009.5 Group I-2. If the occupancy group is changed to Group I-2, the plumbing system ((~~and medical gas system~~)) shall comply with the applicable requirements of the ((~~*International*~~)) *Uniform Plumbing Code*.

SECTION 1010
OTHER REQUIREMENTS

[S] 1010.1 Light and ventilation. Light and ventilation shall comply with the requirements of the *International Building Code* and *International Mechanical Code* for the new occupancy.

SECTION 1011
CHANGE OF OCCUPANCY ((~~CLASSIFICATION~~))

1011.1 General. The provisions of this section shall apply to buildings or portions thereof undergoing a change of occupancy classification. This includes a change of occupancy classification within a group as well as a change of occupancy classification from one group to a different group or where there is a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the *International Building Code*. Such buildings shall also comply with Sections 1002 through 1010 of this code.

1011.2 Fire protection systems. Fire protection systems shall be provided in accordance with Sections 1011.2.1 and 1011.2.2.

[S] 1011.2.1 Fire sprinkler system. Where a change in occupancy classification occurs or where there is a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the *International Building Code* that requires an automatic fire sprinkler system to be provided based on the new occupancy in accordance with Chapter 9 of the *International Building Code.* ((~~The installation of the automatic sprinkler system shall be required within the area of the *change of occupancy* and areas of the building not separated horizontally and vertically from the change of occupancy by one of the following:~~

1. ~~Nonrated permanent partition and horizontal assemblies.~~
2. ~~Fire partition.~~
3. ~~Smoke partition.~~
4. ~~Smoke barrier.~~
5. ~~Fire barrier.~~
6. ~~Fire wall.~~

~~**Exceptions:**~~

~~1. An automatic sprinkler system shall not be required in a one- or two-family dwelling constructed in accordance with the *International Residential Code*.~~

~~2. Automatic sprinkler system shall not be required in a townhouse constructed in accordance with the *International Residential Code*.~~

~~3. The townhouse shall be separated from adjoining units in accordance with Section R302.2 of the *International Residential Code*.~~))

Exception: Subject to the approval of the code official, an automatic fire sprinkler system is not required in dwelling units according to Items 4.1 through 4.6 below. This exception is permitted to be used for the *change of occupancy* for one dwelling unit after October 29, 1990.

1. The occupancy of one unit is permitted to be changed to a dwelling unit without an automatic sprinkler system unless sprinklers are otherwise required by this chapter. If more than one unit is changed, the new units shall be equipped with a sprinkler system.
2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the occupancy of the unit is changed, an automatic sprinkler system shall be provided in the new unit. The change of occupancy shall not be allowed if it increases the nonconformity.
3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.
4. The occupancy of one unit is permitted to be changed to a dwelling unit in an existing duplex without an automatic sprinkler system where both of the following conditions are met:
   - 4.1. The project is considered a *substantial alteration* only because of the change in occupancy; and
   - 4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.
5. Where the occupancy of one unit is changed to a dwelling unit in an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:
   - 5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;
   - 5.2. The project is considered a *substantial alteration* only because of the change in occupancy;
   - 5.3. The new unit is constructed as an addition to the duplex;
   - 5.4. The new unit is separated from the existing duplex by a fire wall; and
   - 5.5. The addition by itself complies with the requirements for a Group R-2 occupancy.
6. A sprinkler system is not required when a Group U occupancy that is accessory to a Group R-3 occupancy is converted to a dwelling unit.

1011.2.2 Fire alarm and detection system. Where a change in occupancy classification occurs or where there is a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the *International Building Code* that requires a fire alarm and detection system to be provided based on the new occupancy in accordance with Chapter 9 of the *International Building Code*, such system shall be provided throughout the area where the *change of occupancy* occurs. Existing alarm notification appliances shall be automatically activated throughout the building. Where the building is not equipped with a fire alarm system, alarm notification appliances shall be provided throughout the area where the *change of occupancy* occurs in accordance with Section 907 of the *International Building Code* as required for new construction.

1011.3 Interior finish. In areas of the building undergoing the *change of occupancy* classification, the interior finish of walls and ceilings shall comply with the requirements of the *International Building Code* for the new occupancy classification.

1011.4 Enhanced classroom acoustics. In Group E occupancies, where the *work area* is a Level 3 *alteration*, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

1011.5 Means of egress, general. Hazard categories in regard to life safety and means of egress shall be in accordance with Table 1011.5.

1011.6 Heights and areas. Hazard categories in regard to height and area shall be in accordance with Table 1011.6.

TABLE 1011.6
HEIGHTS AND AREAS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATIONS
1 (Highest Hazard)	H
2	A-1; A-2; A-3; A-4; I; R-1; R-2; R-4, Condition 2
3	E; F-1; S-1; M
4 (Lowest Hazard)	B; F-2; S-2; A-5; R-3; R-4, Condition 1; U

[S] 1011.6.1 Height and area for change to a higher-hazard category. Where a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.6, heights and areas of buildings and structures shall comply with the requirements of Chapter 5 of the *International Building Code* for the new occupancy classification.

Exception: For high-rise buildings constructed in compliance with a previously issued permit, the type of construction reduction specified in Section 403.2.1 of the *International Building Code* is permitted. ((~~This shall include the reduction for columns.~~)) The high-rise building is required to be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Building Code*.

1011.6.1.1 Fire wall alternative. In other than Groups H, F-1 and S-1, fire barriers and horizontal assemblies constructed in accordance with Sections 707 and 711, respectively, of the *International Building Code* shall be permitted to be used in lieu of fire walls to subdivide the building into separate buildings for the purpose of complying with the area limitations required for the new occupancy where all of the following conditions are met:

1. The buildings are protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Fire Code*.
2. The maximum allowable area between fire barriers, horizontal assemblies or any combination thereof shall not exceed the maximum allowable area determined in accordance with Chapter 5 of the *International Building Code* without an increase allowed for an automatic sprinkler system in accordance with Section 506 of the *International Building Code*.
3. The fire-resistance rating of the fire barriers and horizontal assemblies shall be not less than that specified for fire walls in Table 706.4 of the *International Building Code*.

Exception: Where horizontal assemblies are used to limit the maximum allowable area, the required fire-resistance rating of the horizontal assemblies shall be permitted to be reduced by 1 hour provided that the height and number of stories increases allowed for an automatic sprinkler system by Section 504 of the *International Building Code* are not used for the buildings.

1011.6.2 Height and area for change to an equal or lesser-hazard category. Where a change of occupancy classification is made to an equal or lesser-hazard category as shown in Table 1011.6, the height and area of the *existing building* shall be deemed acceptable.

1011.6.3 Fire barriers. Where a *change of occupancy* classification is made to a higher-hazard category as shown in Table 1011.6, fire barriers in separated mixed use buildings shall comply with the fire-resistance requirements of the *International Building Code*.

Exception: Where the fire barriers are required to have a 1-hour fire-resistance rating, existing wood lath and plaster in good condition or existing 1/2-inch-thick (12.7 mm) gypsum wallboard shall be permitted.

1011.7 Exterior wall fire-resistance ratings. Hazard categories in regard to fire-resistance ratings of exterior walls shall be in accordance with Table 1011.7.

TABLE 1011.7
EXPOSURE OF EXTERIOR WALLS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATION
1 (Highest Hazard)	H
2	F-1; M; S-1
3	A; B; E; I; R
4 (Lowest Hazard)	F-2; S-2; U

1011.7.1 Exterior wall rating for change of occupancy classification to a higher-hazard category. Where a change of occupancy classification is made to a higher hazard category as shown in Table 1011.7, exterior walls shall have fire resistance and exterior opening protectives as required by the *International Building Code*.

CHAPTER 11
ADDITIONS

User note:

About this chapter: *Chapter 11 provides the requirements for additions, which correlate to the code requirements for new construction. There are, however, some exceptions that are specifically stated within this chapter. An "Addition" is defined in Chapter 2 as "an extension or increase in the floor area, number of stories or height of a building or structure." Chapter 11 contains the minimum requirements for an addition that is not separated from the existing building by a fire wall.*

SECTION 1101
GENERAL

[W] 1101.1 Scope. An *addition* to a building or structure shall comply with the International Codes and *Uniform Plumbing Code* as adopted for new construction without requiring the *existing building* or structure to comply with any requirements of those codes or of these provisions, except as required by this chapter. Where an *addition* impacts the *existing building* or structure, that portion shall comply with this code.

1101.2 Creation or extension of nonconformity. An *addition* shall not create or extend any nonconformity in the *existing building* to which the *addition* is being made with regard to accessibility, structural strength, fire safety, means of egress or the capacity of mechanical, plumbing or electrical systems.

[S] 1101.3 Other work. Any ((~~*repair* or~~)) *alteration* work within an *existing building* to which an *addition* is being made shall comply with the applicable requirements for the work as classified in Chapter 6.

1101.4 Enhanced classroom acoustics. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the *addition* with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

SECTION 1102
HEIGHTS AND AREAS

1102.1 Height limitations. An *addition* shall not increase the height of an *existing building* beyond that permitted under the applicable provisions of Chapter 5 of the *International Building Code* for new buildings.

1102.2 Area limitations. An *addition* shall not increase the area of an *existing building* beyond that permitted under the applicable provisions of Chapter 5 of the *International Building Code* for new buildings unless fire separation as required by the *International Building Code* is provided.

Exception: In-filling of floor openings and nonoccupiable appendages such as elevator and exit stairway shafts shall be permitted beyond that permitted by the *International Building Code*.

1102.3 Fire protection systems. Existing fire areas increased by the *addition* shall comply with Chapter 9 of the *International Building Code*.

SECTION 1103
STRUCTURAL

[S] 1103.1 Structural. *Additions* to existing buildings or structures are new construction and shall comply with Section 304.3. *

[BS] ((~~1103.3~~)) 1103.2 Flood hazard areas. *Additions* and *foundations* in *flood hazard areas* shall comply with ((~~the following requirements:~~)) Section 314.

((~~1. For horizontal *additions* that are structurally interconnected to the *existing building*:~~

~~1.1. If the *addition* and all other proposed work, when combined, constitute *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~1.2. If the *addition* constitutes *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

ADDITIONS

~~2. For horizontal *additions* that are not structurally interconnected to the *existing building*:~~

~~2.1. The *addition* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~2.2. If the *addition* and all other proposed work, when combined, constitute *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~3. For vertical *additions* and all other proposed work that, when combined, constitute *substantial improvement*, the *existing building* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~4. For a raised or extended foundation, if the foundation work and all other proposed work, when combined, constitute *substantial improvement*, the *existing building* shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~

~~5. For a new foundation or replacement foundation, the foundation shall comply with Section 1612 of the *International Building Code*, or Section R322 of the *International Residential Code*, as applicable.~~))

* **[S] ((~~SECTION 1104~~**
~~ENERGY CONSERVATION~~

~~**1104.1 Minimum requirements.** *Additions* to *existing buildings* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction.~~))

[S] SECTION 1104
ADDITION OF DWELLING UNITS

[S] 1104.1 Automatic sprinkler systems. Automatic sprinkler systems are required when new dwelling units are added to buildings according to Items 1 through 5 below. This provision is permitted to be used to add one unit after October 29, 1990.

1. One unit is permitted to be added to a residential or commercial building without an automatic sprinkler system unless sprinklers are otherwise required by this section. If more than one unit is added, the new units shall be equipped with a sprinkler system.
2. In buildings that do not comply with the provisions of this code for number of stories, allowable area, height or type of construction before the unit is added, an automatic sprinkler system shall be provided in the new unit. The addition of the new unit shall not be allowed if it increases the nonconformity.
3. In buildings undergoing *substantial alteration*, an automatic sprinkler system shall be installed where required by this code for new construction.
4. One unit is permitted to be added to an existing duplex without an automatic sprinkler system where both of the following conditions are met:
   4.1. The project is considered a *substantial alteration* only because of the change in occupancy; and
   4.2. The building complies with the requirements for building height and number of stories for a Group R-2 occupancy.
5. Where one unit is added to an existing duplex, sprinklers are required in the new unit and not in the existing units where all of the following conditions are met:
   5.1. The existing duplex does not comply with the requirements for building height and story count for a Group R-2 occupancy;
   5.2. The project is considered a *substantial alteration* only because of the change in occupancy;
   5.3. The new unit is constructed as an *addition* to the duplex;
   5.4. The new unit is separated from the existing duplex by a fire wall; and
   5.5. The *addition* by itself complies with the requirements for a Group R-2 occupancy.

[S] 1104.1.1 Fire walls. An existing nonconforming building to which an *addition* is made is permitted to exceed the height, number of stories and area specified for new buildings if a fire wall is provided, the existing building is not made more nonconforming, and the *addition* conforms to this code.

*

CHAPTER 12

HISTORIC BUILDINGS

Note: Chapter 12 is not adopted in The City of Seattle. See Section 310 for provisions for landmark buildings.

CHAPTER 13

PERFORMANCE COMPLIANCE METHODS

User note:

About this chapter: *Chapter 13 allows for existing buildings to be evaluated so as to show that alterations, while not meeting new construction requirements, will improve the current existing situation. Provisions are based on a numerical scoring system involving 19 various safety parameters and the degree of code compliance for each issue.*

SECTION 1301
GENERAL

[S] 1301.1 Scope. The provisions of this chapter shall apply to the *alteration*, *addition* and *change of occupancy* of *existing structures*, ((~~including historic structures,~~)) as referenced in Section 301.3.3. The provisions of this chapter are intended to maintain or increase the current degree of public safety, health and general welfare in *existing buildings* and structures while permitting ((~~,~~)) *alteration*, *addition* and *change of occupancy* without requiring full compliance with Chapters 6 through ((~~12~~)) 11, except where compliance with the prescriptive method of Chapter 5 or the work area method of other provisions of this code is specifically required in this chapter. *Alterations*, *additions* and *changes of occupancy* shall also comply with Chapter 3.

1301.1.1 Compliance with other methods. *Alterations*, *additions* and *changes of occupancy* to *existing structures* shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.

[S] 1301.2 Applicability. *Existing buildings* in which there is work involving *additions*, *alterations* or *changes of occupancy* shall be made to conform to the requirements of this chapter or the provisions of Chapters 6 through ((~~12~~)) 11. The provisions of Sections 1301.2.1 through 1301.2.6 shall apply to existing occupancies that will continue to be, or are proposed to be, in Groups A, B, E, F, I-2, M, R and S. These provisions shall also apply to Group U occupancies where such occupancies are undergoing a *change of occupancy* or a partial change in occupancy with separations in accordance with Section 1301.2.2. These provisions shall not apply to buildings with occupancies in Group H, I-1, I-3 or I-4.

1301.2.1 Change in occupancy. Where an *existing building* is changed to a new occupancy classification and this section is applicable, the provisions of this section for the new occupancy shall be used to determine compliance with this code.

[S] 1301.2.2 Partial change in occupancy. Where a portion of the building is changed to a new occupancy classification and that portion is separated from the remainder of the building with fire barrier or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the *International Building Code* ((~~or Section R302 of the *International Residential Code*~~)) for the separate occupancies, or with *approved* compliance alternatives, the portion changed shall be made to conform to the provisions of this section. Only the portion separated shall be required to be evaluated for compliance.

Where a portion of the building is changed to a new occupancy classification and that portion is not separated from the remainder of the building with fire barriers or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the *International Building Code* ((~~or Section R302 of the *International Residential Code*~~)) for the separate occupancies, or with *approved* compliance alternatives, the provisions of this section which apply to each occupancy shall apply to the entire building. Where there are conflicting provisions, those requirements which secure the greater public safety shall apply to the entire building or structure.

[S] 1301.2.3 Additions. *Additions* to *existing buildings* shall comply with the requirements of the *International Building Code* ((~~or the *International Residential Code*~~)) for new construction. The combined height and area of the *existing building* and the new *addition* shall not exceed the height and area allowed by Chapter 5 of the *International Building Code*. Where a fire wall that complies with Section 706 of the *International Building Code* is provided between the *addition* and the *existing building*, the *addition* shall be considered a separate building.

1301.2.4 Alterations. An *existing building* or portion thereof shall not be altered in such a manner that results in the building being less safe or sanitary than such building is currently.

Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered shall conform to the requirements of the *International Building Code*.

1301.2.5 Escalators. Where escalators are provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).

[S] 1301.2.6 Plumbing fixtures. Plumbing fixtures shall be provided in accordance with Section 1009 for a change of occupancy and Section 808 for *alterations*. Plumbing fixtures for *additions* shall be in accordance with the ((~~*International*~~)) *Seattle Plumbing Code* and Chapter 29 of the *Seattle Building Code*.

[S] 1301.3 Acceptance. For ((~~*repairs*~~,)) *alterations*, *additions* and *changes of occupancy* to *existing buildings* that are evaluated in accordance with this section, compliance with this section shall be accepted by the *code official*.

[S] 1301.3.1 Hazards. Where the *code official* determines that an *unsafe* condition exists as provided for in Section ((~~115~~)) 101.14, such *unsafe* condition shall be abated in accordance with Section ((~~115~~)) 101.14.

[S] 1301.3.2 Compliance with other codes. Buildings that are evaluated in accordance with this section shall comply with ((~~the *International Fire Code* and *International Property Maintenance Code*~~)) Chapter 3.

* **1301.4 Investigation and evaluation.** For proposed work covered by this chapter, the building owner shall cause the *existing building* to be investigated and evaluated in accordance with the provisions of Sections 1301.4 through 1301.9.

[S][BS] 1301.4.1 Structural. ((~~analysis.~~ ~~The owner shall have a structural analysis of the *existing building* made to determine adequacy of structural systems for the proposed *alteration*, *addition* or *change of occupancy*. The analysis shall demonstrate that the building with the work completed is capable of resisting the loads specified in Chapter 16 of the *International Building Code*.~~)) *Alterations*, *additions* and *changes of occupancy* to *existing structures* shall comply with Section 304.

1301.4.2 Submittal. The results of the investigation and evaluation as required in Section 1301.4, along with proposed compliance alternatives, shall be submitted to the *code official*.

1301.4.3 Determination of compliance. The *code official* shall determine whether the *existing building*, with the proposed *addition*, *alteration* or *change of occupancy*, complies with the provisions of this section in accordance with the evaluation process in Sections 1301.5 through 1301.9.

1301.5 Evaluation. The evaluation shall be composed of three categories: fire safety, means of egress and general safety, as defined in Sections 1301.5.1 through 1301.5.3.

1301.5.1 Fire safety. Included within the fire safety category are the structural fire resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the *facility*.

1301.5.2 Means of egress. Included within the means of egress category are the configuration, characteristics and support features for means of egress in the *facility*.

1301.5.3 General safety. Included within the general safety category are the fire safety parameters and the means of egress parameters.

1301.6 Evaluation process. The evaluation process specified herein shall be followed in its entirety to evaluate *existing buildings* in Groups A, B, E, F, M, R, S and U. For *existing buildings* in Group I-2, the evaluation process specified herein shall be followed and applied to each and every individual smoke compartment. Table 1301.7 shall be utilized for tabulating the results of the evaluation. References to other sections of this code or other codes indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined. In applying this section to a building with mixed occupancies, where the separation between the mixed occupancies does not qualify for any category indicated in Section 1301.6.16, the score for each occupancy shall be determined, and the lower score determined for each section of the evaluation process shall apply to the entire building or to each smoke compartment for Group I-2 occupancies.

Where the separation between the mixed occupancies qualifies for any category indicated in Section 1301.6.16, the score for each occupancy shall apply to each portion or smoke compartment of the building based on the occupancy of the space.

1301.6.1 Building height and number of stories. The value for building height and number of stories shall be the lesser value determined by the formula in Section 1301.6.1.1. Section 504 of the *International Building Code* shall be used to determine the allowable height and number of stories of the building. Subtract the actual building height from the allowable height and divide by 12-1/2 feet (3810 mm). Enter the height value and its sign (positive or negative) in Table 1301.7 under Safety Parameter 1301.6.1, Building Height, for fire safety, means of egress and general safety. The maximum score for a building shall be 10.

1301.6.1.1 Height formula. The following formulas shall be used in computing the building height value.

$$\text{Height value, feet} = \frac{(AH) - (EBH)}{12.5} \times CF \qquad \textbf{(Equation 13-1)}$$

$$\text{Height value, stories} = (AS - EBS) \times CF \qquad \textbf{(Equation 13-2)}$$

where:

AH = Allowable height in feet (mm) from Section 504 of the *International Building Code*.
EBH = *Existing building* height in feet (mm).
AS = Allowable height in stories from Section 504 of the *International Building Code*.
EBS = *Existing building* height in stories.

communications system controls, fire department communication system controls, and any other controls specified in Section 911 of the *International Building Code* where those systems are provided.

1301.6.10 Smoke control. Evaluate the ability of a natural or mechanical venting, exhaust or pressurization system to control the movement of smoke from a fire. Under the categories and occupancies in Table 1301.6.10, determine the appropriate value and enter that value into Table 1301.7 under Safety Parameter 1301.6.10, Smoke Control, for means of egress and general safety.

TABLE 1301.6.10
SMOKE CONTROL VALUES

OCCUPANCY	CATEGORIES					
	a	b	c	d	e	f
A-1, A-2, A-3	0	1	2	3	6	6
A-4, E	0	0	0	1	3	5
B, M, R	0	2[a]	3[a]	3[a]	3[a]	4[a]
F, S	0	2[a]	2[a]	3[a]	3[a]	3[a]
I-2	-4	0	0	0	3	0

a. This value shall be 0 if compliance with Category d or e in Section 1301.6.8.1 has not been obtained.

[S] 1301.6.10.1 Categories. The categories for smoke control are:

1. Category a—None.
2. Category b—The building is equipped throughout with an automatic sprinkler system. Openings are provided in exterior walls at the rate of 20 square feet (1.86 m^2) per 50 linear feet (15 240 mm) of exterior wall in each story and distributed around the building perimeter at intervals not exceeding 50 feet (15 240 mm). Such openings shall be readily openable from the inside without a key or separate tool and shall be provided with ready access thereto. In lieu of operable openings, clearly and permanently marked tempered glass panels shall be used.
3. Category c—One enclosed exit stairway, with ready access thereto, from each occupied floor of the building. The stairway has operable exterior windows, and the building has openings in accordance with Category b.
4. Category d—One ((~~smokeproof enclosure~~)) pressurized stairway and the building has openings in accordance with Category b.
5. Category e—The building is equipped throughout with an automatic sprinkler system. Each floor area is provided with a mechanical air-handling system designed to accomplish smoke containment. Return and exhaust air shall be moved directly to the outside without recirculation to other floor areas of the building under fire conditions. The system shall exhaust not less than six air changes per hour from the floor area. Supply air by mechanical means to the floor area is not required. Containment of smoke shall be considered as confining smoke to the floor area involved without migration to other floor areas. Any other tested and *approved* design that will adequately accomplish smoke containment is permitted.
6. Category f—Each stairway shall be one of the following: a ((~~smokeproof enclosure~~)) pressurized stairway in accordance with Section 1023.12 of the *International Building Code*; pressurized in accordance with Section 909.20.5 or 909.20.6 of the *International Building Code*; or shall have operable exterior windows.

1301.6.11 Means of egress capacity and number. Evaluate the means of egress capacity and the number of exits available to the building occupants. In applying this section, the means of egress are required to conform to the following sections of the *International Building Code*: 1003.7, 1004, 1005, 1006, 1007, 1016.2, 1026.1, 1028.3, 1028.5, 1030.2, 1030.3, 1030.4 and 1031. The number of exits credited is the number that is available to each occupant of the area being evaluated. Existing fire escapes shall be accepted as a component in the means of egress when conforming to Section 504.

Under the categories and occupancies in Table 1301.6.11, determine the appropriate value and enter that value into Table 1301.7 under Safety Parameter 1301.6.11, Means of Egress Capacity, for means of egress and general safety.

TABLE 1301.6.11
MEANS OF EGRESS VALUES

OCCUPANCY	CATEGORIES				
	a[a]	b	c	d	e
A-1, A-2, A-3, A-4, E, I-2	-10	0	2	8	10
M	-3	0	1	2	4
B, F, S	-1	0	0	0	0
R	-3	0	0	0	0

a. The values indicated are for buildings six stories or less in height. For buildings over six stories above grade plane, add an additional -10 points.

[S] 1301.6.11.1 Categories. The categories for means-of-egress capacity and number of exits are:

1. Category a—Compliance with the minimum required means-of-egress capacity or number of exits is achieved through the use of a fire escape in accordance with Section ((~~405~~)) 504.
2. Category b—Capacity of the means of egress complies with Section 1005 of the *International Building Code*, and the number of exits complies with the minimum number required by Section 1006 of the *International Building Code*.
3. Category c—Capacity of the means of egress is equal to or exceeds 125 percent of the required means-of-egress capacity, the means of egress complies with the minimum required width dimensions specified in the *International Building Code*, and the number of exits complies with the minimum number required by Section 1006 of the *International Building Code*.
4. Category d—The number of exits provided exceeds the number of exits required by Section 1006 of the *International Building Code*. Exits shall be located a distance apart from each other equal to not less than that specified in Section 1007 of the *International Building Code*.
5. Category e—The area being evaluated meets both Categories c and d.

1301.6.12 Dead ends. In spaces required to be served by more than one means of egress, evaluate the length of the exit access travel path in which the building occupants are confined to a single path of travel. Under the categories and occupancies in Table 1301.6.12, determine the appropriate value and enter that value into Table 1301.7 under Safety Parameter 1301.6.12, Dead Ends, for means of egress and general safety.

TABLE 1301.6.12
DEAD-END VALUES

OCCUPANCY	CATEGORIES[a]			
	a	b	c	d
A-1, A-3, A-4, B, F, M, R, S	-2	0	2	-4
A-2, E	-2	0	2	-4
I-2	-2	0	2	-6

a. For dead-end distances between categories, the dead-end value shall be obtained by linear interpolation.

1301.6.12.1 Categories. The categories for dead ends are:

1. Category a—Dead end of 35 feet (10 670 mm) in nonsprinklered buildings or 70 feet (21 340 mm) in sprinklered buildings.
2. Category b—Dead end of 20 feet (6096 mm); or 50 feet (15 240 mm) in Group B in accordance with Section 1020.5, Exception 2, of the *International Building Code*.
3. Category c—No dead ends; or ratio of length to width (l/w) is less than 2.5:1.
4. Category d—Dead ends exceeding Category a.

1301.6.13 Maximum exit access travel distance to an exit. Evaluate the length of exit access travel to an *approved* exit. Determine the appropriate points in accordance with the following equation and enter that value into Table 1301.7 under Safety Parameter 1301.6.13, Maximum Exit Access Travel Distance for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1017.1 of the *International Building Code*.

$$\text{Points} = 20 \times \frac{\text{Maximum allowable travel distance} - \text{Maximum actual travel distance}}{\text{Maximum allowable travel distance}} \qquad \textbf{(Equation 13-7)}$$

1301.6.14 Elevator control. Evaluate the passenger elevator equipment and controls that are available to the fire department to reach all occupied floors. Emergency recall and in-car operation of elevators shall be provided in accordance with the *International Fire Code*. Under the categories and occupancies in Table 1301.6.14, determine the appropriate value and enter that value into Table 1301.7 under Safety Parameter 1301.6.14, Elevator Control, for fire safety, means of egress and general safety. The values shall be zero for a single-story building.

CHAPTER 14

RELOCATED OR MOVED BUILDINGS

Note: Chapter 14 is not adopted in The City of Seattle. See Section 313 for provisions applying to relocated buildings and structures.

CHAPTER 15

CONSTRUCTION SAFEGUARDS

User note:

About this chapter: *Chapter 15 looks to the construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. Issues such as how to provide egress and adequate water supply while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed. Note that this chapter is consistent with Chapter 33 of the* International Building Code *and Chapter 33 of the* International Fire Code*.*

SECTION 1501
GENERAL

[BG] 1501.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

[BG] 1501.2 Storage and placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

[BG] 1501.3 Alterations, repairs and additions. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during *alterations*, *repairs* or *additions* to any building or structure. *

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the *existing building* is not occupied.

[BG] 1501.4 Manner of removal. Waste materials shall be removed in a manner that prevents injury or damage to persons, adjoining properties and public rights-of-way.

[BG] 1501.5 Fire safety during construction. Fire safety during construction shall comply with the applicable requirements of the *International Building Code* and the applicable provisions of Chapter 33 of the *International Fire Code*.

[S][BS] 1501.6 Protection of pedestrians. ((~~Pedestrians shall be protected during construction and demolition activities as required by Sections 1501.6.1 through 1501.6.7 and Table 1501.6. Signs shall be provided to direct pedestrian traffic.~~)) The protection of the public and of the sidewalks, streets and other public property during construction or demolition shall be provided as required by the Street Use Ordinance, Seattle Municipal Code Title 15.

[S] ((~~[BS] TABLE 1501.6~~
~~PROTECTION OF PEDESTRIANS~~

~~HEIGHT OF CONSTRUCTION~~	~~DISTANCE OF CONSTRUCTION TO LOT LINE~~	~~TYPE OF PROTECTION REQUIRED~~
~~8 feet or less~~	~~Less than 5 feet~~	~~Construction railings~~
	~~5 feet or more~~	~~None~~
~~More than 8 feet~~	~~Less than 5 feet~~	~~Barrier and covered walkway~~
	~~5 feet or more, but not more than one-fourth the height of construction~~	~~Barrier and covered walkway~~
	~~5 feet or more, but between one-fourth and one-half the height of construction~~	~~Barrier~~
	~~5 feet or more, but exceeding one-half the height of construction~~	~~None~~

~~For SI: 1 foot = 304.8 mm.~~))

[S] ((~~[BS] 1501.6.1 Walkways.~~ ~~A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a building entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface and shall be accessible in accordance with Chapter 11 of the *International Building Code*. Walkways shall be designed to support all imposed loads and the design live load shall be not less than 150 pounds per square foot (psf) (7.2 kN/m^2).~~))

CONSTRUCTION SAFEGUARDS

[S] ((~~[BS] 1501.6.2 Directional barricades.~~ ~~Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.~~))

[S] ((~~[BS] 1501.6.3 Construction railings.~~ ~~Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.~~))

[S] ((~~[BS] 1501.6.4 Barriers.~~ ~~Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.~~

~~**[BS] 1501.6.4.1 Barrier design.** Barriers shall be designed to resist loads required in Chapter 16 of the *International Building Code* unless constructed as follows:~~

1. ~~Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.~~
2. ~~The barrier material shall be boards not less than 3/4 inch (19.1 mm) in thickness or wood structural use panels not less than 1/4 inch (6.4 mm) in thickness.~~
3. ~~Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.~~
4. ~~Wood structural use panels 1/4 inch (6.4 mm) or 15/16 inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.~~
5. ~~Wood structural use panels 3/8 inch (9.5 mm) or 1/2 inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center, provided that a 2 inch by 4 inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.~~
6. ~~Wood structural use panels 5/8 inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).~~))

[S] ((~~[BS] 1501.6.5 Covered walkways.~~ ~~Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. The design live load shall be not less than 150 psf (7.2 kN/m^2) for the entire structure.~~

~~**Exception:** Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6 kN/m^2) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:~~

1. ~~Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.~~
2. ~~Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.~~
3. ~~Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge on the posts.~~
4. ~~Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.~~
5. ~~The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than 23/32 inch (18.3 mm) thick nailed to the joists.~~
6. ~~Each post shall be knee-braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.~~
7. ~~A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.~~))

[S] ((~~[BS] 1501.6.6 Repair, maintenance and removal.~~ ~~Pedestrian protection required by Section 1501.6 shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.~~))

[S] ((~~[BS] 1501.6.7 Adjacent to excavations.~~ ~~Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the *code official*. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16 of the *International Building Code*.~~))

[W][BG] 1501.7 Facilities required. Sanitary facilities shall be provided during construction or demolition activities in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

SECTION 1502
PROTECTION OF ADJOINING PROPERTY

[S][BS] 1502.1 Protection required. Adjoining public and private property shall be protected from damage during construction and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. ((~~The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.~~)) When the existing grade of a site is altered by filling, excavating, dredging or moving of earth materials, the owner shall protect all adjoining property during construction from encroachment or collapse by sloping the sides of the temporary grading at a slope that is safe and not more than one horizontal to one vertical. In addition, adjoining property shall be protected from encroachment or collapse by sloping the sides of the permanent grading at a slope not greater than two horizontal to one vertical. The *code official* is authorized to approve temporary or permanent slopes that are steeper based on a design by an experienced geotechnical engineer.

In areas of known unsuitable soils, the *code official* is authorized to require slopes that are less steep to assure protection of adjoining property.

[S] ((~~[BS] 1502.2 Excavation retention systems.~~ ~~Where a retention system is used to provide support of an excavation for protection of adjacent structures, the system shall conform to the requirements in Section 1502.2.1 through 1502.2.3.~~

~~[BS] 1502.2.1 Excavation retention system design.~~ ~~Excavation retention systems shall be designed by a *registered design professional* to provide vertical and lateral support.~~

~~[BS] 1502.2.2 Excavation retention system monitoring.~~ ~~The retention system design shall include requirements for monitoring of the system and adjacent structures for horizontal and vertical movement.~~

~~[BS] 1502.2.3 Retention system removal.~~ ~~Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by backfill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.~~))

SECTION 1503
TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

[S] ((~~[BG] 1503.1 Storage and handling of materials.~~ ~~The temporary use of streets or public property for the storage or handling of materials or equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.~~))

[S] 1503.1 General. Temporary use of streets, alleys and public property shall comply with the Street Use Ordinance, Seattle Municipal Code Title 15.

[S] ((~~[BG] 1503.2 Obstructions.~~ ~~Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.~~))

[S] ((~~[BG] 1503.3 Utility fixtures.~~ ~~Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.~~))

SECTION 1504
FIRE EXTINGUISHERS

[F] 1504.1 Where required. Structures under construction, *alteration* or demolition shall be provided with not fewer than one *approved* portable fire extinguisher in accordance with Section 906 of the *International Fire Code* and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 1504.2 Fire hazards. The provisions of this code and of the *International Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 1505
MEANS OF EGRESS

[BE] 1505.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1505.2 Maintenance of means of egress. Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or *alterations* and *additions* to any building.

Exception: Existing means of egress need not be maintained where *approved* temporary means of egress and accessible means of egress systems and facilities are provided.

SECTION 1506
STANDPIPES

[F] 1506.1 Where required. In buildings required to have standpipes by Section 905.3.1 of the *International Building Code*, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to *stairways*, complying with Section 1505.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1506.2 Buildings being demolished. Where a building or portion of a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 1506.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9 of the *International Building Code*.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 of the *International Building Code* as to capacity, outlets and materials.

SECTION 1507
AUTOMATIC SPRINKLER SYSTEM

[S][F] 1507.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code or the *International Building Code*, it shall be unlawful to occupy any portions of a building or structure until the automatic sprinkler system installation has been tested and *approved*, ((~~except as provided in Section 110.3~~)) unless approved by the *code official*.

[F] 1507.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 1508
ACCESSIBILITY

[BE] 1508.1 Construction sites. Structures, sites and equipment directly associated with the actual process of construction, including, but not limited to, scaffolding, bridging, material hoists, material storage or construction trailers, are not required to be accessible.

SECTION 1509
WATER SUPPLY FOR FIRE PROTECTION

[F] 1509.1 When required. An *approved* water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building material arrives on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 1509.1 through 1509.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] 1509.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials as measured along an *approved* fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] 1509.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 1509.3.1 through 1509.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] 1509.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] 1509.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be constructed upon, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] 1509.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] 1509.4 Vertical construction, Types I and II construction. If combustible construction materials are delivered to the construction site, water supply in accordance with Section 1509.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] 1509.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 1506, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

[S] SECTION 1510
DEMOLITION

1510.1 Construction documents. Construction documents and a schedule for demolition shall be submitted where required by the *code official*. Where such information is required, no work shall be done until such construction documents or schedule, or both, are approved.

1510.2 Pedestrian protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter and the Street Use Ordinance, Seattle Municipal Code Title 15.

1510.3 Means of egress. A horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

1510.4 Surface condition and fill. The site shall be left level and free of debris upon completion of demolition, and all holes shall be filled or protected with secure fences. Holes are permitted to be filled with concrete, rocks or other nondecaying material no larger than 12 inches (305 mm) in diameter. Wood and other organic material shall not be buried on the site. Leaving the site level means:

1. The grade conforms to that existing on all sides;
2. Surface water will drain off;
3. Surface is smooth; and
4. Broken sections of the foundation or other material are not exposed.

The site shall be seeded upon completion of the demolition if it is to be left vacant for more than 6 months.

1510.5 Water accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

1510.6 Utility connections. Service utility connections shall be discontinued and capped in accordance with requirements of the governing utility or agency including, but not limited to, Seattle Public Utilities, Seattle Department of Transportation, Seattle Fire Department, Seattle City Light, Puget Sound Energy and Qwest Communications.

1510.7 Fire safety during demolition. Fire safety during demolition shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *International Fire Code*.

1510.8 Removal of hazardous and combustible materials. All asbestos and other hazardous material shall be removed prior to demolition, in accordance with regulations of the Environmental Protection Agency, the Puget Sound Clean Air Agency and other pertinent agencies. Combustible waste shall be removed in accordance with the Fire Code. During demolition, streets and sidewalks shall be left clean at the end of each day's operation.

1510.9 Welding and cutting. Welding and cutting shall be performed in accordance with the *International Fire Code*.

1510.10 Erosion and sediment control. Provision shall be made to stabilize ground conditions to eliminate dust and erosion. Demolition sites shall comply with the Seattle Stormwater Code, Seattle Municipal Code (SMC) Title 22, Subtitle VIII, and the Seattle Grading Code, SMC Chapter 22.170.

1510.11 Drainage. If the demolition will result in a change of drainage patterns, the flow of all watercourses, including streams, ditches, drains, combined sewers and runoff, intercepted during the progress of the work, shall be returned to the condition present before the demolition or as specified on the permit, and in accordance with the Seattle Stormwater Code and Seattle Grading Code, SMC Title 22, Subtitle VIII, and SMC Chapter 22.170, respectively.

1510.12 Foundations and footings. All concrete or masonry floors, foundations, footings, basement walls and retaining walls not to be reused shall be removed to 18 inches (457 mm) below final grade. All concrete floors left in place shall be broken so as to allow water to drain through unless the floors are to be used.

1510.13 Engineer's report. The *code official* is permitted to require a structural engineer's analysis of proposed demolition or any portions of a structure remaining after demolition.

1510.14 Underground tanks. When demolition occurs, all underground tanks on the site shall either be removed or filled, as required by the *International Fire Code*.

[S] SECTION 1511
SITE WORK

1511.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of not less than 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms which have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

1511.1.1 Slope limits. Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations shall be permitted only upon the presentation of a soil investigation report acceptable to the *code official*.

1511.1.2 Surcharge. No fill or other surcharge loads shall be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations which can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against later movement.

1511.1.3 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with *International Building Code* Section 1804.5. Special inspections of compacted fill shall be in accordance with *International Building Code* Section 1705.6.

[S] SECTION 1512
CONSTRUCTION MATERIAL MANAGEMENT

1512.1 Storage and handling of materials. Materials stored and handled on site during construction shall comply with the manufacturer's printed instructions. Where manufacturer's printed instructions are not available, approved standards or guidelines shall be followed.

1512.2 Construction phase moisture control. Porous or fibrous materials and other materials subject to moisture damage shall be protected from moisture during construction. Material damaged by moisture or that is visibly colonized by fungi either prior to delivery or during construction shall be cleaned and dried or, where damage cannot be corrected by such means, shall be removed and replaced.

CHAPTER 16
REFERENCED STANDARDS

User note:

About this chapter: *This code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 16 contains a comprehensive list of all standards that are referenced in the code, including the appendices. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the building code official, contractor, designer and owner.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

562-21: Assessment, Repair, and Rehabilitation of Existing Concrete Structures
405.1.1

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

7—1988: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—1993: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—1995: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—1998: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—2002: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—2005: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—2010: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
((~~503.12, 706.3.2~~))

7—2016: Minimum Design Loads and Associated Criteria for Buildings and Other Structures with Supplement No. 1, Supplement No. 2, and Supplement No. 3
303.1.7, 304.2, 304.3.1, 503.4, 503.12, 503.13, 706.3.2, 801.3, 805.3, 805.4

41—2017: Seismic Evaluation and Retrofit of Existing Buildings
304.3.1, Table 304.3.1, 304.3.2, Table 304.3.2

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329

62.1—2019: Ventilation for Acceptable Indoor Air Quality
807.2

REFERENCED STANDARDS

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016

A17.1—2019/CSA B44—19: Safety Code for Elevators and Escalators
306.7.7 ((~~, 902.1.2~~))

((~~A17.3—2020: Safety Code for Existing Elevators and Escalators~~
~~902.1.2~~))

A18.1—2020: Safety Standard for Platform Lifts and Stairway Chair Lifts
306.7.8

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

C94/C94M—17A: Specification for Ready-mixed Concrete
109.3.1

E108—17: Standard Test Methods for Fire Tests of Roof Coverings
1204.5

E136—16A: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
202

F2006—17: Standard Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows
505.2, 702.4

F2090—17: Standard Specification for Window Fall Prevention Devices with Emergency (Egress) Release Mechanisms
505.2, 505.3.1, 702.4, 702.5.1

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington, DC 20001

IBC—21: International Building Code®
101.4.1, 104.2.1, 106.2.2, 109.3.3, 109.3.6, 109.3.9, 109.3.10, 110.2, 202, 301.3, 302.4.1, 302.5, ((~~303.1~~)) 303.1.3, 303.1.3.1, 303.1.4, 303.1.7, 303.2.2, 303.3.1.1, 304.1, 304.3.1, 304.3.2, 305.1, 306.5, 306.7, 306.7.2, 306.7.4, 306.7.5, 306.7.9, 306.7.10, 306.7.10.1, 306.7.10.2, 306.7.10.3, 306.7.11, 306.7.12, 306.7.13, 306.7.15, 306.7.16, 306.7.16.3, 306.7.16.4, 306.7.16.5, 306.7.16.7, 308.1, 308.3, 309.2, 310.1, 401.3, 402.1, 405.2.1.1, 405.2.3.1, 405.2.3.3, 405.2.4, 405.2.5, 405.2.6, 501.2, 502.1, 502.3, ((~~502.4,~~)) 502.5, 503.1, 503.2, 503.3, 503.4, 503.5, 503.11, 503.12, 503.13, 503.14, 503.15, 503.17, 503.18, 505.3, 505.4, 506.1, 506.3, 506.4, 506.5.1, 506.5.2, 506.5.3, 506.5.4, 507.3, 701.2, ((~~701.3,~~)) 702.1, 702.2, 702.3, 702.5, 702.6, 702.7, 704.1.1, 704.3, ((~~705.1,~~)) 705.2, 706.2, 706.3.2, 802.2.1, 802.2.3, 802.3, 802.4, 802.5.2, 802.6, 802.6, 803.1.1, 803.2, 803.2.2, 803.2.3, 803.2.4, 803.2.5, 803.3, 804.1, 804.4.1, 804.4.1.1, Table 804.4.1.1(1), 804.4.1.2.1, 804.5.1.2, 804.5.3, 804.5.4, 804.5.5, 804.6, 804.7, 804.8.1, 804.9.1, 804.10.2, 804.11, 804.12.2, 805.2, 805.3, 805.4, 904.1.2, 904.1.3, 904.1.4, 904.1.6, 904.1.7, 904.2, 904.2.1, 904.2.2, 905.2, 905.3, 905.4, 906.2, 906.3, 906.6, 1001.2, 1001.3, 1002.1, 1002.2, 1002.3, 1002.4, 1004.1, 1006.1, 1006.2, 1006.3, 1006.4, 1010.1, 1011.1, 1011.2.1, 1011.2.2, 1011.3, 1011.5.1, 1011.5.2, 1011.5.3, 1011.5.6, 1011.6.1, 1011.6.1.1, 1011.6.3, 1011.7.1, 1011.7.2, 1011.7.3, 1011.8.1, 1011.8.2, 1011.8.3, 1102.1, 1102.2, 1102.3, ((~~1103.1,~~)) 1103.2, 1103.3, 1201.4, 1202.2, 1203.12, 1204.2, 1204.9, 1206.1, 1301.2.2, 1301.2.3, 1301.2.4, 1301.3.3, 1301.4.1, 1301.6.1, 1301.6.1.1, 1301.6.2, 1301.6.2.1, 1301.6.3.2, 1301.6.3.3, 1301.6.4.1, 1301.6.5, 1301.6.5.1, 1301.6.6, 1301.6.7.1, 1301.6.8, 1301.6.9, 1301.6.9.1, 1301.6.10, 1301.6.10.1, 1301.6.11, 1301.6.11.1, 1301.6.12.1, 1301.6.13, Table 1301.6.15, 1301.6.15.1, 1301.6.16.1, 1301.6.17, 1301.6.17.1, 1301.6.18, 1301.6.18.1, 1301.6.19, Table 1301.6.19, 1301.6.20, 1301.6.20.1, 1301.9.1, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6, 1501.5, 1501.6.1, 1501.6.4.1, 1501.6.7, 1506.1, 1506.3, 1507.1

ICC 300—17: ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands
301.1.1

ICC—continued

ICC 500—20: Standard for the Design and Construction of Storm Shelters
303.1, 303.2

ICC A117.1—17: Accessible and Usable Buildings and Facilities
306.3, 306.7, 306.7.11, 306.7.12

IECC—21: International Energy Conservation Code®
302.2 ((~~, 702.7, 708.1, 809.1, 907.1, 1104.1~~))

IFC—21: International Fire Code®
101.2.1, 101.4.2, 301.3.1, 302.2, 307.1, 308.1, 502.3, 502.4, 802.2.1, 802.2.3, 803.2.3, 803.4.1.1, 803.4.1.2, 803.4.1.3, 803.4.1.4, 803.4.1.5, 803.4.1.6, 904.1.5, 1011.6.1.1, 1301.3.2, 1301.6.8.1, 1301.6.14, 1301.6.14.1, 1401.2, 1501.5, 1504.1, 1504.2

IFGC—21: International Fuel Gas Code®
302.2, 702.7.1

IMC—21: International Mechanical Code®
302.2, 702.7, 807.1, 902.1.1, 1008.1, 1301.6.7.1, 1301.6.8, 1301.6.8.1

IPC—21: International Plumbing Code®
302.2, 408.1, 702.7, 1009.1, 1009.2, 1009.3, 1009.5, 1501.7

IPMC—21: International Property Maintenance Code®
101.4.2, 302.2, 1301.3.2, 1401.2

IRC—21: International Residential Code®
101.2, 101.4.1, 104.2.1, 109.3.3, 109.3.10, 302.2, 307.1, 308.1, 310.1, 310.1.1, 401.3, 402.1, 405.2.6, ((~~502.3,~~)) 502.4, ((~~502.5,~~)) 503.2, 503.3, 503.11, 505.2, 505.3, 507.3, 701.3, 702.4, 702.5, 706.2, 708.1, 805.2, 806.4, 809.1, 906.2, 907.1, 1011.2.1, ((~~1103.1, 1103.2, 1103.3,~~)) 1104.1, 1201.4, 1301.2.2, 1301.2.3, 1301.3.3, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

NFPA 13R—19: Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height
803.2.4

NFPA 70—20: National Electrical Code
107.3, 302.2, 406.1.1, 406.1.2, 406.1.3, 406.1.5, 806.1, 806.4.4, 1007.1, 1007.2, 1007.3, 1007.4

NFPA 72—19: National Fire Alarm and Signaling Code
803.2.6, 803.4

NFPA 99—21: Health Care Facilities Code
302.2.1, 406.1.4, 408.3, 501.3, 707.1, 806.3, 808.1, 1007.1

NFPA 101—21: Life Safety Code
804.2

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

790—04: Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through October 2018
1204.5

[BS] COLLAR JOINT. The vertical space between adjacent wythes. A collar joint may contain mortar or grout.

[BS] CROSSWALL. A new or existing wall that meets the requirements of Section A111.3. A crosswall is not a shear wall.

[BS] CROSSWALL SHEAR CAPACITY. The unit shear value times the length of the crosswall, $v_c L_c$.

[BS] DETAILED BUILDING SYSTEM ELEMENTS. The localized elements and the interconnections of these elements that define the design of the building.

[BS] DIAPHRAGM EDGE. The intersection of the horizontal diaphragm and a shear wall.

[BS] DIAPHRAGM SHEAR CAPACITY. The unit shear value times the depth of the diaphragm, $v_u D$.

[BS] FLEXIBLE DIAPHRAGM. A diaphragm of wood or untopped metal deck construction in which the horizontal deformation along its length is at least two times the average story drift.

HEAD JOINT. The vertical mortar joint placed between masonry units within the wythe.

[BS] NORMAL WALL. A wall perpendicular to the direction of seismic forces.

[BS] OPEN FRONT. An exterior building wall line on one side only without vertical elements of the seismic force-resisting system in one or more stories.

[BS] POINTING. The process of removal of deteriorated mortar from between masonry units and placement of new mortar. Also known as repointing or tuckpointing for purposes of this chapter.

[BS] REPOINTING. See "*Pointing*."

[BS] RIGID DIAPHRAGM. A diaphragm of concrete construction or concrete-filled metal deck construction.

[BS] TUCKPOINTING. See "*Pointing*."

[BS] UNREINFORCED MASONRY (URM). Includes burned clay, concrete or sand-lime brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

[BS] UNREINFORCED MASONRY BEARING WALL. A URM wall that provides the vertical support for the reaction of floor or roof-framing members for which the total superimposed vertical load exceeds 100 pounds per linear foot (1459 N/m) of wall length.

[BS] UNREINFORCED MASONRY WALL. A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than the minimum amounts as defined for reinforced masonry walls.

[BS] YIELD STORY DRIFT. The lateral displacement of one level relative to the level above or below at which yield stress is first developed in a frame member.

SECTION A104
SYMBOLS AND NOTATIONS

[S][BS] A104.1 Symbols and notations. For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.

a_n = Diameter of core multiplied by its length or the area of the side of a square prism.

A = Cross-sectional area of unreinforced masonry pier or wall, square inches (10^{-6} m^2).

A_b = Total area of the bed joints above and below the test specimen for each in-place shear test, square inches (10^{-6} m^2).

A_n = Area of net mortared or grouted section of a wall or wall pier.

D = In-plane width dimension of pier, inches (10^{-3} m), or depth of diaphragm, feet (m).

DCR = Demand-capacity ratio specified in Section A111.4.2.

f'_m = Lower bound masonry compressive strength.

f_{sp} = Tensile-splitting strength of masonry.

F_{wx} = Force applied to a wall at level x, pounds (N).

H = Least clear height of opening on either side of a pier, inches (10^{-3} m).

h/t = Height-to-thickness ratio of URM wall. Height, h, is measured between wall anchorage levels and/or slab-on-grade.

L = Span of diaphragm between shear walls, or span between shear wall and open front, feet (m).

L_c = Length of crosswall, feet (m).

L_i = Effective diaphragm span for an open-front building specified in Section A111.8, feet (m).

P = Applied force as determined by standard test method of ASTM C496 or ASTM E519, pounds (N).

P_D = Superimposed dead load at the location under consideration, pounds (N). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.

P_{D+L} = Stress resulting from the dead plus actual live load in place at the time of testing, pounds per square inch (kPa).

P_{test} = Splitting tensile test load determined by standard test method ASTM C496, pounds (N).

P_w = Weight of wall, pounds (N).

R = Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where $R = 1.5$.

S_{DS} = Design spectral acceleration at short period, in g units.

S_{D1} = Design spectral acceleration at 1-second period, in g units.

v_a = The shear strength of any URM pier, $v_m A/1.5$ pounds (N).

v_c = Unit shear strength for a crosswall sheathed with any of the materials given in Table A108.1(1) or Table A108.1(2), pounds per foot (N/m).

v_{mL} = Shear strength of unreinforced masonry, pounds per square inch (kPa).

V_{aa} = The shear strength of any URM pier or wall, pounds (N).

V_{ca} = Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, $v_c L_c$, pounds (N).

V_{cb} = Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, $v_c L_c$, pounds (N).

V_p = Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).

V_r = Pier rocking shear capacity of any URM wall or wall pier, pounds (N).

v_{test} = Load at incipient cracking for each in-place shear test performed in accordance with Section ((~~A106.2.3.6~~)) A106.2.3.2, pounds (N).

v_{tl} = Lower bound mortar shear strength, pounds per square inch (kPa).

v_{to} = Mortar shear test values as specified in Section A106.2.3.6, pounds per square inch (kPa).

v_u = Unit shear capacity value for a diaphragm sheathed with any of the materials given in Table A108.1(1) or A108.1(2), pounds per foot (N/m).

V_{wx} = Total shear force resisted by a shear wall at the level under consideration, pounds (N).

W = Total seismic dead load as defined in the building code, pounds (N).

W_d = Total dead load tributary to a diaphragm level, pounds (N).

W_w = Total dead load of a URM wall above the level under consideration or above an open-front building, pounds (N).

W_{wx} = Dead load of a URM wall assigned to level x halfway above and below the level under consideration, pounds (N).

$\Sigma v_u D$ = Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).

$\Sigma\Sigma v_u D$ = For diaphragms coupled with crosswalls, $v_u D$ includes the sum of shear capacities of both ends of diaphragms coupled at and above the level under consideration, pounds (N).

ΣW_d = Total dead load of all the diaphragms at and above the level under consideration, pounds (N).

SECTION A105
GENERAL REQUIREMENTS

[BS] A105.1 General. The seismic force-resisting system specified in this chapter shall comply with the *International Building Code* and referenced standards, except as modified herein.

[BS] A105.2 Alterations and repairs. *Alterations* and *repairs* required to meet the provisions of this chapter shall comply with applicable structural requirements of the building code unless specifically provided for in this chapter.

[BS] A105.3 Requirements for plans. The following construction information shall be included in the plans required by this chapter:

1. Dimensioned floor and roof plans showing existing walls and the size and spacing of floor and roof-framing members and sheathing materials. The plans shall indicate all existing URM walls, and new crosswalls and shear walls, and their materials of construction. The location of these walls and their openings shall be fully dimensioned and drawn to scale on the plans.

2. Dimensioned URM wall elevations showing openings, piers, wall classes as defined in Section A106.2.3.9, thickness, heights, wall shear test locations, cracks or damaged portions requiring *repairs*, the general condition of the mortar joints, and if and where pointing is required. Where the exterior face is veneer, the type of veneer, its thickness and its bonding and/or ties to the structural wall masonry shall be noted.
3. The type of interior wall and ceiling materials, and framing.
4. The extent and type of existing wall anchorage to floors and roof where used in the design.
5. The extent and type of parapet corrections that were previously performed, if any.
6. *Repair* details, if any, of cracked or damaged unreinforced masonry walls required to resist forces specified in this chapter.
7. All other plans, sections and details necessary to delineate required retrofit construction.
8. The design procedure used shall be stated on both the plans and the permit application.
9. Details of the anchor prequalification program required by Section A107.5.3, if used, including location and results of all tests.
10. Quality assurance requirements of special inspection for all new construction materials and for retrofit construction including: anchor tests, pointing or repointing of mortar joints, installation of adhesive or mechanical anchors, and other elements as deemed necessary to ensure compliance with this chapter.

[BS] A105.4 Structural observation, testing and inspection. Structural observation, in accordance with Section 1704.6 of the *International Building Code*, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for compliance with the *approved* construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new and existing construction materials shall be in accordance with the building code, except as modified by this chapter.

Special inspection as described in Section A105.3, Item 10, shall be provided equivalent to Level 3 as prescribed in TMS 402, Table 3.1(2).

SECTION A106
MATERIALS REQUIREMENTS

[BS] A106.1 Condition of existing materials. Existing materials used as part of the required vertical load-carrying or seismic force-resisting system shall be evaluated by on-site investigation and: determined to be in good condition (free of degraded mortar, degraded masonry units or significant cracking); or shall be repaired, enhanced, retrofitted or removed and replaced with new materials. Mortar joint deterioration shall be patched by pointing or repointing of the eroded joint in accordance with Section A106.2.3.10. Existing significant cracks in solid unit unreinforced and solid grouted hollow unit masonry shall be repaired.

[BS] A106.2 Existing unreinforced masonry.

[BS] A106.2.1 General. Unreinforced masonry walls used to support vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. Masonry that does not meet the minimum requirements established by this chapter shall be repaired, enhanced, removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.

[BS] A106.2.2 Lay-up of walls. Unreinforced masonry walls shall be laid in a running bond pattern.

[BS] A106.2.2.1 Header in multiple-wythe solid brick. The facing and backing wythes of multiple-wythe walls shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing wythes. The clear distance between adjacent header courses shall not exceed 24 inches (610 mm) vertically or horizontally. Where backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers for which the area and spacing conform to the foregoing. Wythes of walls not meeting these requirements shall be considered to be veneer, and shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity strength of the wall.

Exception: Where SD1 is 0.3 g or less, veneer wythes anchored and made composite with backup masonry are permitted to be used for calculation of the effective thickness.

[S][BS] A106.2.2.2 Lay-up patterns. Lay-up patterns other than those specified in Section A106.2.2.1 are allowed if their performance can be justified to the *code official*.

CHAPTER A2

EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE AND REINFORCED MASONRY WALL BUILDINGS WITH FLEXIBLE DIAPHRAGMS

Appendix A2 is not adopted by The City of Seattle.

CHAPTER A5

REFERENCED STANDARDS

SECTION A501
REFERENCED STANDARDS

A501.1 General. See Table A501.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that references the standard.

[S] TABLE A501.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
AISC 341-16	*Seismic Provisions for Structural Steel Buildings*	A403.10.1, A403.10.2
ASCE/SEI 7 —16	*Minimum Design Loads for Buildings and Other Structures with Supplement No. 1*	A104.1, A205.1, A206.1, A206.2, A206.3, A206.4, A206.7, A403.3
ASTM A36/A36M— 14	*Specification for Carbon Structural Steel*	A405.3.3
ASTM A653/A653M —15	*Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process*	A304.2.6
ASTM B695 —04(2009)	*Standard Specification for Coating of Zinc Mechanically Deposited on Iron and Steel*	A304.2.6
ASTM C67- 14	*Test Methods of Sampling and Testing Brick and Structural Clay Tile*	A106.2.3.1
ASTM C140/C140M —15	*Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units*	A106.2.3.1
ASTM C496 —96/C496M —11	*Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens*	A104.1, A106.2.3.3
ASTM C1531—15	*Standard Test Methods for In Situ Measurement of Masonry Mortar Joint Shear Strength Index*	A106.2.3.2
ASTM E488/E488M —15	*Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements*	A107.5.1, A107.5.3
ASTM E488—10	*Test Method for Strength of Anchors in Concrete and Masonry Elements*	A107.5
ASTM E519/E519M —2010	*Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages*	A104.1, A106.2.3.2
IBC—00	*International Building Code*	A202.1
IBC—03	*International Building Code*	A202.1
IBC—06	*International Building Code*	A202.1
IBC—09	*International Building Code*	A202.1
IBC—12	*International Building Code*	A202.1
IBC—15	*International Building Code*	A202.1
IBC—18	*International Building Code*	A202.1
IBC—21	*International Building Code*	A102.2, A105.1, A105.4, A202.1, A203.1, A204.1, A205.1, A205.3, A205.3.1, A205.4, A301.3, A304.1.1, A403.1, A405.1, A407.1, A407.2, A407.3
UBC—97	*Uniform Building Code*	A202.1

[S] CHAPTER A6

ALTERNATE METHOD FOR THE SEISMIC IMPROVEMENT OF UNREINFORCED MASONRY (URM) BUILDINGS

SECTION A601
GENERAL

A601.1 Purpose. The purpose of this chapter is to establish an alternate method for the seismic retrofit of *URM buildings* with the goal of improving seismic life safety. This alternate method provides a minimally acceptable level of life safety risk from earthquakes that is a lesser level than the *substantial alteration* seismic regulations established in Section 311.1.2.

A601.2 General requirements. Where this Chapter A6 is used, the construction documents shall include a statement on the structural notes demonstrating that the building has been evaluated and/or retrofitted to comply with this Chapter A6.

SECTION A602
DEFINITIONS

The definitions in the SBC and SEBC shall apply in addition to the definitions of this chapter.

BED JOINT. The horizontal layer of mortar on which a masonry unit is laid.

CROSSWALL. A new or existing wood-framed wall(s) sheathed with any material with a cumulative length of at least 50 percent of the diaphragm depth between diaphragm chords. Individual walls shall have a maximum height-to-length ratio of 1.5 to be considered a crosswall. The minimum crosswall length may be reduced to 25% of the diaphragm depth if it can be shown that the crosswalls do not consist of unblocked gypsum wall board.

POINTING. The process of removal of deteriorated mortar from between masonry units and placement of new mortar. Also known as *repointing* or *tuckpointing* for purposes of this chapter.

REPOINTING. See "Pointing."

TUCKPOINTING. See "Pointing."

SECTION A603
QUALIFICATION CRITERIA

Buildings that demonstrate compliance with, or are altered to comply with, qualification criteria (1) through (7) of this section are permitted to be strengthened in compliance with Section A604.

(1) The building is no more than 6 stories above the seismic base of the structure.

(2) The building shall not be classified as Risk Category IV.

(3) The building does not have a Weak Story vertical irregularity as defined by ASCE 7-16 as referenced by the SBC.

(4) The building has a mortar shear strength, v_{to}, as determined by Section A604.2, of 30 psi or more for all masonry classes.

(5) The building has wood or plywood diaphragms at all levels above the base of the building.

(6) The building does not have straight sheathed floor or roof diaphragms.

Exceptions:

i. Straight sheathed floor diaphragms with finished wood flooring with offset or perpendicular board edges.

ii. Straight sheathed floor or roof diaphragms without finished wood flooring with offset or perpendicular board edges where any of the following conditions are met:

(1) The building has *crosswalls* below the non-compliant level at a spacing that does not exceed 40 feet on center; or

(2) The diaphragm span is less than 24 feet and the diaphragm aspect ratio is less than 2-to-1.

(7) The building has or will be provided with a minimum of two lines of vertical elements of the lateral force resisting system parallel to each axis located near or on the perimeter of the building. Where the lateral force resisting system is a masonry wall:

i. The piers shall have a height-to-width ratio that does not exceed 2-to-1.

ii. The piers shall occupy not less than 40 percent of the wall's length.

iii. The piers shall not be comprised of hollow clay block or hollow clay tile.

Lateral force resisting frames or walls added to provide a minimum of two lines of vertical elements of the lateral force resisting system shall comply with the seismic regulations for *Substantial Alterations* per the Seattle Existing Building Code.

Exception: Item seven qualification criteria for masonry walls do not apply if the applicant submits a report prepared by a licensed Structural Engineer that shows all walls comply with a maximum demand/capacity ratio of 2.5 for in-plane forces. One of the following two methods shall be used to determine the demand/capacity ratio:

i. ASCE 41 Chapter 16: Special Procedure for *Unreinforced Masonry* where seismic hazard is determined using Section A604.1 with $S_{XS} = S_{DS}$ and $S_{X1} = S_{D1}$; or

ii. Chapter A1 of the Seattle Existing Building Code where seismic hazard is determined using Section A604.1.

SECTION A604
SEISMIC IMPROVEMENT METHOD

Elements shall comply with, or be altered to comply with, the requirements listed in this section for wall anchorage (tension anchors), diaphragm shear transfer (shear anchors), out-of-plane wall bracing, and parapet/appendage bracing.

Structural testing and inspection for new and existing construction materials shall be in accordance with the building code, except as modified by this chapter. Where special inspections and tests are required in this chapter, they shall be performed by an *approved agency*. Evaluation of the condition of existing materials and testing results is the responsibility of the *structural engineer in responsible charge*.

A604.1 Seismic hazard. For application of this Seismic Improvement Method, spectral response acceleration parameters, S_{DS} and S_{D1}, shall be determined by using one of the following methods.

(1) Seventy-five percent of the values established in ASCE 7-16 as referenced by the 2021 Seattle Building Code; or

(2) Seventy-five percent of the values established in ASCE 7-22, and the Site class, as defined in ASCE 7-22, shall be determined by a qualified geotechnical engineer. In lieu of a geotechnical engineer determination, site class may be determined utilizing available Seattle Department of Construction and Inspections (SDCI) map, Director's Rule DR 2-2023 Update of Environmentally Critical Area (ECA) Liquefaction-Prone Areas Map, that defines Liquefaction Prone Areas (type ECA5). Where the project site is Type ECA5, site class E shall be used. Where the site is not ECA5, the default site class shall be used.

A604.2 Materials requirements.

A604.2.1 Unreinforced masonry classes. Existing *unreinforced masonry* shall be categorized into one or more classes based on shear strength, quality of construction, state of repair, deterioration, and weathering. Classes are defined for whole walls, not for small areas of masonry within a wall. Discretion in the definition of classes of masonry is permitted to avoid unnecessary testing.

A604.2.2 Condition of existing materials. Existing materials used as part of the required vertical load-carrying or seismic force-resisting system shall be evaluated by on-site investigation and determined to be in good condition (free of degraded mortar, degraded masonry units and/or significant cracking); or shall be repaired, enhanced, retrofitted or removed and replaced with new materials.

A604.2.2.1 Mortar joint deterioration shall be patched by *pointing* or *repointing* of the eroded joint in accordance with Section A604.2.3.3. Existing significant cracks in solid unit unreinforced and solid grouted hollow unit masonry shall be repaired.

A604.2.3 Testing of masonry. All *unreinforced masonry* (URM) walls used to carry vertical loads or resist seismic forces parallel and perpendicular to the wall plane shall be tested. The shear tests shall be taken at locations representative of the mortar conditions throughout the building. Test locations shall be determined by the design professional in charge. Results of all tests and their locations shall be recorded, and these results shall be submitted to the Code Official for approval as part of the structural analysis.

The minimum number of tests per masonry class shall be determined as follows:

(1) At each story, not less than one test per wall or line of wall elements providing a common line of resistance to seismic forces;

(2) Not less than one test per 1,500 ft^2 (140 m^2) of wall surface or not less than a total of eight tests.

Exception to (1) and (2): Required tests at all other stories besides the first and top stories may be reduced to one test per wall line per two stories with approval of the Code Official. Condition of masonry at skipped levels shall be similar to adjacent levels and tested results at adjacent levels shall show low variation in shear strength.

A604.2.3.1 In-place mortar tests. Mortar shear test values, v_{to}, shall be obtained by one of the following:

(1) ASTM C1531;

(2) Alternative methods of testing may be approved by the Code Official for masonry walls other than brick or where in-place testing is not practical because of crushing or other failure mode of the masonry.

A604.2.3.2 Minimum quality of mortar.

(1) Mortar shear test values, v_{to}, in pounds per square inch, shall be obtained for each in-place shear test in accordance with the following equation:

$$v_{to} = (V_{test}/A_b) - P_{(D+L)} \quad \textbf{(Equation A6-1)}$$

V_{test} = Load at first observed movement
A_b = Total area of the *bed joints* above and below the test specimen.
$P_{(D+L)}$ = Stress resulting from actual dead plus live loads in place at the time of testing.

(2) Individual *unreinforced masonry* walls with more than 50 percent of mortar test values, v_{to}, less than 30 pounds per square inch (207 kPa) shall be pointed prior to construction and retested.

(3) The lower bound mortar shear strength, v_{tl}, is defined as the mean minus one standard deviation of the mortar shear test values, v_{to}.

(4) *Unreinforced masonry* with mortar shear strength, v_{tl}, less than 30 pounds per square inch (207 kPa) shall be pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements of the building. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent *bed joints* of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be not greater than that of the weakest wythe of that class.

A604.2.3.3 Pointing. Deteriorated mortar joints in *unreinforced masonry* walls shall be pointed in accordance with the following requirements:

(1) Joint Preparation. Deteriorated mortar shall be cut out by means of a toothing chisel or nonimpact power tool until sound mortar is reached, to a depth not less than 3/4 inch (19.1 mm) or twice the thickness of the joint, whichever is less, but not greater than 2 inches (50 mm). Care shall be taken not to damage the masonry edges. After cutting is complete, all loose material shall be removed with a brush, or air or water stream.

(2) Mortar Preparation. The mortar mix shall be proportioned as required by the construction specifications and manufacturer's approved instructions.

(3) Packing. The joint into which the mortar is to be packed shall be dampened but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding 1/4 inch (6.4 mm) deep until it is filled; then it shall be tooled to a smooth surface to match the original profile.

Nothing shall prevent *pointing* of any masonry wall joints before testing is performed in accordance with Section A604.2.3.

Preparation and mortar *pointing* shall be performed with special inspection.

Exception: Incidental *pointing* may be performed without special inspection subject to the approval of the Code Official.

A604.3 Testing of anchors.

A604.3.1 Existing wall anchors. Existing wall anchors used as all or part of the required tension anchors shall be tested in pullout according to Section A604.3.3.1. Not fewer than four anchors tested per floor shall be tested in pullout, with not fewer than two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

Exception: Existing tension anchors that extend entirely through the wall and meet the criteria in Table 1 need not be tested.

A604.3.2 New wall anchors. New wall anchors embedded in URM walls resisting tension forces or a combination of tension and shear forces shall be subject to special inspection, prior to placement of the anchor and grout or adhesive in the drilled hole. Five percent of all anchors resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A604.3.3.

Exception: New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

A604.3.3 Tests of anchors in unreinforced masonry walls. Tests of anchors in *unreinforced masonry* walls shall be in accordance with Section A604.3.3.1 through A604.3.3.3. Results of all tests shall be reported to the authority having jurisdiction. The report shall include the test results of maximum load for each test; pass-fail results; corresponding anchor size

and type; orientation of loading; details of the anchor installation, testing apparatus and embedment; wall thickness; and joist orientation and proximity to the tested anchor.

A604.3.3.1 Direct tension testing of existing anchors and new anchors. The test apparatus shall be supported by the masonry wall. The test procedure for prequalification of tension anchors shall comply with ASTM E488. Existing wall anchors shall be given a preload of 300 pounds (1335 N) before establishing a datum for recording elongation. The tension test load shall be the lesser of the target test load or the load recorded at 1/8 inch (3.2 mm) relative movement between the existing anchor and the adjacent masonry surface. New embedded tension anchors shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for five minutes.

Exception: Where obstructions occur, the distance between the anchor and the test apparatus support shall be not less than one-half the wall thickness for existing anchors and 75% of the embedment length for new embedded anchors.

A604.3.3.2 Torque testing of new anchors. Anchors embedded in *unreinforced masonry* walls shall be tested using a torque-calibrated wrench to the following minimum torques:

1/2-inch-diameter bolts: 40 foot pounds
5/8-inch-diameter bolts: 50 foot pounds
3/4-inch-diameter bolts: 60 foot pounds

A604.3.3.3 Prequalification tests for bolts and other types of anchors. ASTM E488 or the test procedure in Section A604.3.3.1 is permitted to be used to determine tension or shear strength values for anchors greater than those permitted by Table 2 or that deviate from required spacing, edge distances or embedment. Anchors shall be installed in the same manner and using the same materials as will be used in the actual construction. Not fewer than five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The tension and shear strength values for such anchors shall be the lesser of the average ultimate load divided by 5.0 or the average load at which 1/8 inch (3.2 mm) elongation occurs for each size and type of anchor and class of masonry.

A604.4 Design strengths.

(1) Strength values for existing materials are given in Table 1 and for new materials in conjunction with existing materials in Table 2.

(2) The strength reduction factor, Φ, shall be taken equal to 1.0.

(3) The use of materials not specified herein shall be based on substantiating research data or engineering judgment, as approved by the Code Official.

TABLE 1
STRENGTH VALUES FOR EXISTING MATERIALS

Existing Materials or Configuration of Materials[a]		Strength Values X 14.594 for N/m
Horizontal diaphragms	Roofs with straight sheathing and roofing applied directly to the sheathing.	300 lbs. per ft. for seismic shear
	Roofs with diagonal sheathing and roofing applied directly to the sheathing.	750 per ft. for seismic shear
	Floors with straight tongue-and-groove sheathing.	300 per ft. for seismic shear
	Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular.	1,500 per ft. for seismic shear
	Floors with diagonal sheathing and finished wood flooring.	1,800 per ft. for seismic shear
	Metal deck welded with minimal welding.[b]	1,800 per ft. for seismic shear
	Metal deck welded for seismic resistance.[c]	3,000 per ft. for seismic shear
Tension anchors	Rosette-style anchors, 1/2-inch minimum diameter, extending entirely through *unreinforced masonry* wall with bearing plates on the far side of a wall 30 square inches of area.	5,400 lbs. per anchor for three-wythe minimum walls 2,700 lbs. for two-wythe walls

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 pound = 4.4 N, 1 pound per square inch = 6894.75 N/m^2, 1 pound per foot = 14.43 N/m.

a. Material must be sound and in good condition

b. Minimum 22-gage steel deck with welds to support satisfying the standards of the Steel Deck Institute.

c. Minimum 22-gage steel deck with 3/4-inch diameter plug welds at an average spacing not exceeding 8 inches and with sidelap welds appropriate for the deck span.

TABLE 2
STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION

New Materials or Configuration of Materials		Strength Values
Tension anchors[e]	Anchors extending entirely through *unreinforced masonry* wall secured with bearing plates on far side of a wall 30 square inches of area.[b, c]	5,400 lbs. per anchor for three-wythe minimum walls. 2,700 lbs. for two-wythe walls.
Shear bolts[d, e]	Anchors embedded not less than 8 inches into *unreinforced masonry* walls; anchors should be centered in 2 1/2 inch diameter holes with dry-pack or non-shrink grout around the circumference of the anchor.	The value for plain masonry specified for solid masonry TMS 402; and no value larger than those given for 3/4 inch bolts should be used. Use f'm = 285psi or test for a higher value.
Combined tension and shear anchors[e]	Through-anchors: anchors meeting the requirements for shear and for tension anchors.[b, c]	Tension: same as for tension anchors. Shear: same as for shear anchors.
	Embedded anchors- anchors extending to the exterior face of the wall with a 2 1/2 inch round plate under the head and drilled at an angle of 22 1/2 degrees to the horizontal; installed as specified for shear anchors.[a, b, c]	Tension: 3,600 lbs. per anchor. Shear: same as for shear anchors.

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 pound = 4.4 N, 1 degree = 0.017 rad, 1 pound per foot = 14.43 N/m, 1 foot = 304.8 mm.

a. Embedded anchors to be tested as specified in Section A604.3.2.

b. Anchors shall be 1/2 inch minimum diameter.

c. Drilling for anchors shall be done with an electric rotary drill; impact tools should not be used for drilling holes or tightening anchors and shear bolt nuts.

d. Other bolt sizes, values and installation methods may be used, provided that a testing program is conducted in accordance with Section A604.3.3.3. The strength value shall be determined by multiplying the calculated allowable value, determined in accordance with Section A604.3.3.3, by 3.0, and the usable value shall be limited to not greater than 1.5 times the value given in the table. Bolt spacing shall not exceed 6 feet on center and shall be not less than 12 inches on center.

e. An alternative adhesive anchor bolt system is permitted to be used providing: its properties and installation conform to an ICC Evaluation Service Report; and the report states that the system's use is in *unreinforced masonry* as an acceptable alternative to Sections A604.3.2 and A604.5 or TMS 402, Section 2.1.4. The report's allowable values shall be multiplied by a factor of three to obtain strength values and the strength reduction factor, Φ, shall be taken equal to 1.0.

A604.5 Wall anchorage (tension bolts).

A604.5.1 General. *Unreinforced masonry* walls shall be anchored at the roof and floor levels for out-of-plane tension forces in accordance with Sections A604.5.2 and A604.5.3. Wall anchors shall be secured to the framing members parallel or perpendicular to the wall to develop the required forces in accordance with the Seattle Building Code.

A604.5.2 Wall anchorage forces. Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as 0.9 S_{DS} times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof.

S_{DS} = Design spectral acceleration at short period, in *g* units.

A604.5.3 Anchor spacing. Maximum anchor spacing is 6 feet (1829 mm) with a minimum of two anchors on walls 6 feet (1829 mm) or shorter in length.

A604.5.4 Anchors at corners. At the roof and floor levels, tension anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

A604.6 Diaphragm shear transfer (shear bolts).

A604.6.1 Diaphragm shear transfer demand, V_d. Diaphragms shall be connected to *unreinforced masonry* wall elements with connections capable of developing the diaphragm- loading tributary to the wall elements given by the lesser of the following equations:

$$V_d = 1.2\, S_{D1}\, C_p\, W_d \qquad \textbf{(Equation A6-2)}$$

$$V_d = v_d D \qquad \textbf{(Equation A6-3)}$$

S_{D1} = Design spectral acceleration at 1-second period, in g units.

C_p = Horizontal Force Factor per Table 3

W_d = Total dead load tributary to the diaphragm along the wall under consideration, pounds (N).

v_d = Existing diaphragm shear strength determined per Table 1.

D = Depth of the diaphragm, feet (m).

TABLE 3
HORIZONTAL FORCE FACTOR, Cp

Configuration of Materials	C_p
Roofs with straight or diagonal sheathing and roofing applied directly to the sheathing, or floors with straight tongue-and-groove sheathing.	0.50
Diaphragms with double or multiple layers of boards with edges offset, and blocked plywood systems.	0.75
Diaphragms of metal deck without topping:	
Minimal welding or mechanical attachment	0.6
Welded or mechanically attached for seismic resistance	0.68

A604.6.2 Anchor requirements. Anchors transmitting shear forces shall have a maximum spacing of 6 feet (1829 mm) with a minimum of two anchors on walls 6 feet (1829 mm) or shorter in length, and they shall have nuts installed over malleable iron or plate washers where bearing on wood, and heavy-cut washers where bearing on steel. At the roof and floor levels, both shear anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

A604.7 Out-of-plane wall bracing.

A604.7.1 General. Where an *unreinforced masonry* wall height-to-thickness ratio exceeds the limits of Table 4, the wall shall be laterally supported by vertical bracing members per Section A604.7.2 or by reducing the wall height by bracing per Section A604.7.3. Bracing members shall be connected to the horizontal floor and roof diaphragms per Section A604.7.4.

A604.7.2 Vertical bracing members. Vertical bracing members shall be attached to floor and roof construction for their design loads independently of required wall anchors. Horizontal spacing of vertical bracing members shall not exceed one-half of the unsupported height of the wall or 10 feet (3048 mm). Deflection of such bracing members at design loads shall not exceed one-tenth of the wall thickness. Design loads shall be determined by multiplying the weight of the wall by 0.4 S_{DS} and shall not be less than 10 percent of the wall weight. Spacing of anchors attaching to the vertical bracing member shall be as required by design, but shall not be less than 6 feet on center.

A604.7.3 Intermediate wall bracing. The wall height may be reduced by bracing elements connected to the floor or roof. Horizontal spacing of the bracing elements and wall anchors shall be as required by design, but shall not exceed 6 feet (1829 mm) on center. Bracing elements shall be detailed to minimize the horizontal displacement of the wall by the vertical displacement of the floor or roof. Design loads shall be determined by multiplying the weight of the wall by 0.4 S_{DS} and shall not be less than 10 percent of the wall weight.

A604.7.4 Bracing attachment. Bracing members shall be connected to the floor and roof diaphragms using blocking, nailing, or other means, in accordance with the Seattle Building Code. The brace connection to the diaphragm shall be capable of resisting a force of 0.9 S_{DS} times the weight of the wall tributary to the brace.

TABLE 4
ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS[a]

Wall Types	$0.13_g \le S_{D1} < 0.25_g$	$0.25_g \le S_{D1} < 0.4_g$	$S_{D1} \ge 0.4_g$ All other Buildings
Walls of one-story buildings	20	16	13
First-story wall of multiple story building	20	18	15
Walls in top story of multiple-story building	14	14	9
All other walls	20	16	13

For SI: 1 pound per square inch = 6894.75 N/m^2

a. Alternative height-to-thickness ratios are permitted to be considered, subject to approval by the Code Official.

A604.8 Parapets and appendage bracing.

A604.8.1 General. *Unreinforced masonry* parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions. Where a parapet is removed or altered, the resulting parapet shall be no less conforming to the provisions of the Seattle Building Code for fire protection than it was prior to the alteration.

The maximum height of an unbraced *unreinforced masonry* parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table 5. If the required parapet height exceeds this maximum height, a bracing system designed for the forces per Section A604.8.2 shall support the top of the parapet.

The height of a URM parapet above any wall anchor shall be not less than 12 inches (305 mm).

Exception: If a reinforced concrete beam is provided at the top of the wall, the height above the wall anchor is permitted to be not less than 6 inches (152 mm).

TABLE 5
MAXIMUM ALLOWABLE HEIGHT-TO-THICKNESS RATIO FOR PARAPETS

	S_{D1}		
	$0.13_g \le S_{D1} < 0.25_g$	$0.25_g \le S_{D1} < 0.4_g$	$S_{D1} \ge 0.4_g$
Maximum allowable height-to- thickness ratios	2.5	2.5	1.5

A604.8.2 Parapet bracing forces. Anchorage of parapet wall to the roof shall resist a minimum force determined as 0.48 S_{DS} times the tributary weight acting normal to the wall at the level of the floor or roof.

A604.8.3 Additional requirements. Where provided, parapet bracing shall be spaced at a maximum of 8 feet on center. Where the tension roof anchors are not adequate or non-existent, roof construction must be tied to the parapet per Section A604.5.

APPENDIX B

SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS FOR EXISTING BUILDINGS AND FACILITIES

Appendix B is not adopted by The City of Seattle.

APPENDIX C: GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS

CHAPTER C1

GABLE END RETROFIT FOR HIGH-WIND AREAS

Appendix C1 is not adopted by The City of Seattle.

CHAPTER C2

ROOF DECK FASTENING FOR HIGH-WIND AREAS

Appendix C2 is not adopted by The City of Seattle.

CHAPTER C3

REFERENCED STANDARDS

Appendix C3 is not adopted by The City of Seattle.

APPENDIX D

BOARD OF APPEALS

Appendix D is not adopted by The City of Seattle.

CHAPTER 1
SCOPE AND ADMINISTRATION

Note: Chapter 1 is entirely Seattle amendments to the *International Fuel Gas Code* and is not underlined.

SECTION 101
TITLE

101.1 Title. These regulations shall be known as the "Seattle Fuel Gas Code," may be cited as such, and are referred to herein as "this code." All references to the *International Fuel Gas Code* contained in this code mean the *Seattle Fuel Gas Code*.

SECTION 102
PURPOSE

102.1 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation, and maintenance or use of fuel gas systems within the City.

The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

SECTION 103
APPLICABILITY AND SCOPE

103.1 Scope. This code applies to the erection, installation, alteration, repair, relocation, replacement, addition to, use or maintenance of fuel gas piping systems, fuel-gas utilization equipment and related accessories within the City. The design and testing of equipment regulated by this code are subject to the approval of the code official.

Exceptions:

1. Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane with a separate means of egress and their accessory structures shall comply with the *International Residential Code*.
2. The standards for liquefied petroleum gas installations are the 2017 edition of NFPA 58 (*Liquefied Petroleum Gas Code*) and the 2018 edition of ANSI Z223.1/NFPA 54 (*National Fuel Gas Code*), as amended.

103.2 Applicability of city laws. A mechanical permit application shall be considered under the *Seattle Mechanical, Fuel Gas* and *Energy* codes in effect on a date as provided below, or on a date as otherwise required by law.

1. Mechanical permit applications shall be considered under the codes in effect on the date used to determine the codes applicable to the building permit application according to *Seattle Building Code* Section 101.3 if any of Items 1.1 through 1.3 apply:
   1.1. The mechanical permit application is submitted as part of a building permit application;
   1.2. The mechanical permit application is for work directly associated with a building permit but is submitted separately from the building permit application; or
   1.3. The mechanical permit application is for initial tenant alterations submitted no later than 18 months after the date of the approved final inspection for the building, and is submitted before the expiration date of the building permit for the tenant alteration, as determined by *Seattle Building Code* Section 106.9.
2. Mechanical permit applications other than those subject to Item 1 shall be considered under the codes in effect on the date a complete mechanical permit application is submitted that complies with all the requirements of Section 114.

103.3 Additions, alterations and repairs. Additions, alterations, repairs and replacement of equipment or systems shall comply with the provisions for new equipment and systems except as otherwise provided in Section 104 of this code.

103.4 Internal consistency. If in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. If there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

103.5 Referenced codes and standards. The codes and standards referenced in this code are part of the requirements of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the equipment or appliance, the conditions of the listing and manufacturer's instructions apply.

103.6 Appendices. Provisions in the *International Fuel Gas Code* appendices do not apply unless specifically adopted.

103.7 Metric units. Wherever in this code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

103.8 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, including local amendments. References to the "Building Code", "Mechanical Code", "Fire Code", "Residential Code" and "Plumbing Code" mean the Seattle editions of those codes.

SECTION 104
APPLICATION TO EXISTING MECHANICAL SYSTEMS

104.1 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs may be made to any mechanical system without requiring the existing mechanical system to comply with all the requirements of this code, if the addition, alteration, renovation or repair conforms to the standards required for a new mechanical system. Additions, alterations, renovations or repairs shall not cause an existing system to become unsafe, unhealthy or overloaded.

Minor additions, alterations, renovations, and repairs to existing mechanical systems may be installed in accordance with the law in effect at the time the original installation was made, if approved by the code official.

104.2 Existing installations. Mechanical systems lawful at the time of the adoption of this code may continue their use, be maintained or repaired, be converted to another type of fuel, or have components replaced if the use, maintenance, repair, conversion of fuel, or component replacement is done in accordance with the basic original design and location, and no hazard to life, health or property has been or is created by such mechanical system.

104.3 Changes in building occupancy. Mechanical systems that are a part of a building or structure undergoing a change in use or occupancy as defined in the *International Building Code* shall comply with all requirements of this code that are applicable to the new use or occupancy.

104.4 Maintenance. All mechanical systems, materials, equipment, appurtenances and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices or safeguards that were required by a code in effect when the mechanical system was installed shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent is responsible for maintenance of mechanical systems and equipment. To determine compliance with this subsection, the code official may cause a mechanical system or equipment to be reinspected.

The fire chief and the code official each have authority to obtain compliance with the requirements of this subsection.

Exception: The code official may modify the requirements of this section where all or a portion of the building is unoccupied.

104.5 Moved buildings. Building or structures moved into or within the City shall comply with standards adopted by the code official. No building shall be moved into or within the City unless, prior to moving, the code official has inspected the building for compliance with this code and the permit holder has agreed to correct all deficiencies found and has been issued a building permit for the work. A bond or cash deposit in an amount sufficient to abate or demolish the building shall be posted prior to issuance of a permit. See Section 114 for information required on plans. Any moved building that is not in complete compliance with standards for moved buildings within eighteen months from the date of permit issuance and is found to be a public nuisance may be abated.

104.6 Landmarks—Historic buildings and structures. The code official may modify the specific requirements of this code as it applies to landmarks and require in lieu thereof alternate requirements that, in the opinion of the code official, will result in a reasonable degree of safety to the public and the occupants of those buildings.

For purposes of this section a landmark is a building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

SECTION 105
ALTERNATE MATERIALS AND METHODS OF CONSTRUCTION

105.1 Alternate materials and methods of construction and design. This code does not prevent the use of any material, design or method of construction not specifically allowed or prohibited by this code, provided the alternate has been approved and its use authorized by the code official. The code official may approve an alternate, provided the code official finds that the proposed alternate complies with the provisions of this code and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation. The code official may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The code official may, but is not required to, record the approval of alternates and any relevant information in the files of the code official or on the approved construction documents.

SECTION 106
MODIFICATIONS

106.1 Modifications. The code official may modify the provisions of this code for individual cases if the code official finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety and sanitation when considered together with other safety features of the building or other relevant circumstances. The code official may, but is not required to, record the approval of modifications and any relevant information in the files of the code official or on the approved construction documents.

SECTION 107
TESTS

107.1 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code or evidence that any material or method of construction does not conform to the requirements of this code, the code official may require tests as proof of compliance, to be made at no expense to the City. Test methods shall be as specified in this code or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the code official shall determine the test procedures. All tests shall be made by an approved agency. Reports of such tests shall be retained by the code official for the period required for retention of public records.

SECTION 108
ORGANIZATION AND DUTIES OF CODE OFFICIAL

108.1 Jurisdiction of the Department of Construction and Inspections. The Department of Construction and Inspections is authorized to administer and enforce this code. Enforcement of Chapters 4 and 7 are the primary responsibility of the Director of Public Health. The Department of Construction and Inspections is under the administrative and operational control of the Director, who is the code official.

108.2 Designees. The code official may appoint such officers, inspectors, assistants and employees as are authorized from time to time. The code official may authorize such employees and other agents as may be necessary to carry out the functions of the code official.

108.3 Right of entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the code official may enter a building or premises at any reasonable time to perform the duties imposed by this code.

108.4 Liability. Nothing in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City, or its officers, employees or agents, for any injury or damage resulting from the failure of equipment to conform to the provisions of this code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or approval authorized or issued or done in connection with the implementation or enforcement of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

This code shall not be construed to lessen or relieve the responsibility of any person owning, operating or controlling any equipment, building or structure for any damages to persons or property caused by defects, nor shall the Seattle Department of Construction and Inspections or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

108.5 Responsibility for compliance. Compliance with the requirements of this code is the obligation of the owner of the building, structure or premises, the authorized agent of the owner, and other persons responsible for the condition or work, and not of the City or any of its officers, employees or agents.

SECTION 109
UNSAFE EQUIPMENT AND HAZARD CORRECTION ORDER

109.1 Emergency order. Whenever the code official finds that any equipment regulated by this code is in such a dangerous and unsafe condition as to constitute an imminent hazard to life or limb, the code official may issue an emergency order. The emergency order may (1) direct that the equipment be restored to a safe condition by a date certain; (2) require that the building, structure or premises, or portion thereof, containing the equipment be vacated within a reasonable time to be specified in the order, or in the case of extreme danger, the order may specify immediate vacation of the building, structure or premises, or portion thereof; or (3) authorize immediate disconnection of the utilities or energy source.

109.1.1 Service of emergency order. The order shall be posted on the premises or personally served on the owner of the building or premises or any person responsible for the condition. The order shall specify the time for compliance.

109.1.2 Effect of emergency order. No person may occupy a building, structure or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure or premises, or portion thereof, is restored to a safe condition as required by the order and this code. It is a violation for any person to fail to comply with an emergency order issued by the code official.

109.2 Hazard correction order. Whenever the code official finds that unsafe equipment exists, the code official may issue a hazard correction order specifying the conditions causing the equipment to be unsafe and directing the owner or other person responsible for the unsafe equipment to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the code official analyzing said conditions and establishing that the equipment is, in fact, safe. The code official may require that the report or analysis be prepared by a licensed engineer.

109.2.1 Service of hazard correction order. The order shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first class mail.

109.2.2 Effect of hazard correction order. It is a violation for any person to fail to comply with a hazard correction order as specified in this subsection.

SECTION 110
ENFORCEMENT, VIOLATIONS AND PENALTIES

110.1 Violations. It is a violation of this code for any person to:

1. Install, erect, construct, enlarge, alter, repair, replace, remodel, move, improve, remove, convert or demolish, equip, occupy, use or maintain any mechanical system or equipment, or cause or permit the same to be done, in the City, contrary to or in violation of any of the provisions of this code.
2. Knowingly aid, abet, counsel, encourage, hire, induce or otherwise procure another to violate or fail to comply with this code.
3. Use any material or install any device, appliance or equipment that is subject to this code and has not been approved by the code official.
4. Violate or fail to comply with any order issued by the code official pursuant to the provisions of this code or with any requirements of this code.
5. Remove, mutilate, destroy or conceal any notice or order issued or posted by the code official pursuant to the provisions of this code, or any notice or order issued or posted by the code official in response to a natural disaster or other emergency.
6. Conduct work under a permit without requesting an inspection as required by Section 116.

110.2 Notice of violation. If, after investigation, the code official determines that standards or requirements of this code have been violated or that orders or requirements have not been complied with, the code official may issue a notice of violation upon the owner, agent, or other person responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance.

110.2.1 Service of notice of violation. The notice shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail. Nothing in this section limits or precludes any action or proceeding to enforce this code, and nothing obligates or requires the code official to issue a notice of violation prior to the imposition of civil or criminal penalties.

110.2.2 Review of notice of violation by the code official. Any person affected by a notice of violation issued pursuant to Section 110.2 may obtain a review of the notice by making a request in writing to the code official within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or city holiday, the period runs until 5 p.m. of the next business day.

110.2.2.1 Review procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the code official unless otherwise agreed to by the person requesting the review. Any person affected by the notice of violation may submit additional information to the code official. The review shall be made by a representative of the code official who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and a site visit.

110.2.2.2 Decision. After the review, the code official shall:

1. Sustain the notice;
2. Withdraw the notice;
3. Amend the notice; or
4. Continue the review to a date certain.

110.2.2.3 Order. The code official shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the persons requesting the review and the persons named on the notice of violation, addressed to their last known address.

110.3 Stop work orders. The code official may issue a stop work order whenever any work is being done contrary to the provisions of this code, or contrary to a permit issued by the code official, or in the event of dangerous or unsafe conditions related to equipment or construction. The stop work order shall identify the violation and may prohibit work or other activity on the site.

110.3.1 Service of stop work order. The code official shall serve the stop work order by posting it in a conspicuous place at the site. If posting is not physically possible, the stop work order may be served by personal service or by regular first class mail to the last known address of: the property owner, the person doing or causing the work to be done, or the holder of a permit if work is being stopped on a permit. For purposes of this section, service is complete at the time of posting or of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or city holiday, the period runs until 5 p.m. on the next business day.

110.3.2 Effective date of stop work order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the persons identified in Section 110.3.1 is served.

110.3.3 Review of stop work orders by the code official. Any person aggrieved by a stop work order may obtain a review of the order by delivering to the code official a request in writing within two business days of the date of service of the stop work order.

110.3.3.1 Review procedure. The review shall occur within two business days after receipt by the code official of the request for review unless otherwise agreed by the person making the request. Any person affected by the stop work order may submit additional information to the code official for consideration as part of the review at any time prior to the review. The review will be made by a representative of the code official who will review all additional information received and may also request a site visit.

110.3.3.2 Decision. After the review, the code official may:

1. Sustain the stop work order;
2. Withdraw the stop work order;
3. Modify the stop work order; or
4. Continue the review to a date certain.

110.3.3.3 Order. The code official shall issue an order containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first class mail to the person or persons requesting the review, any person on whom the stop work order was served, and any other person who requested a copy before issuance of the order, addressed to their last known address.

110.4 Authority to disconnect utilities in emergencies. The code official has the authority to disconnect fuel-gas utility service or energy supplies to a building, structure, premises or equipment regulated by this code in case of emergency where necessary to eliminate an immediate hazard to life or property. The code official may enter any building or premises to disconnect utility service. The code official shall, whenever possible, notify the serving utility, the owner and the occupant of the building, structure or premises of the decision to disconnect prior to taking such action, and shall notify the serving utility, owner and occupant of the building, structure or premises in writing of such disconnection immediately thereafter.

110.5 Authority to condemn equipment. Whenever the code official determines that any equipment or portion thereof regulated by this code is hazardous to life, health or property, the code official shall order in writing that such equipment either be

disconnected, removed or restored to a safe or sanitary condition, as appropriate. The written notice shall fix a date certain for compliance with such order. It is a violation for any person to use or maintain defective equipment after receiving such notice.

When any equipment or installation is to be disconnected, the code official shall give written notice of such disconnection and causes therefore within 24 hours to the serving utility, the owner and the occupant of the building, structure or premises. When any equipment is maintained in violation of this code, and in violation of a notice issued pursuant to the provisions of this section, the code official shall institute any appropriate action to prevent, restrain, correct or abate the violation.

110.6 Connection after order to disconnect. No person shall make connections from any energy, fuel or power supply nor supply energy or fuel to any equipment regulated by this code that has been disconnected or ordered to be disconnected by the code official, or the use of which has been ordered to be discontinued by the code official until the code official authorizes the reconnection and use of such equipment.

110.7 Civil penalties. Any person violating or failing to comply with the provisions of this code is subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved. In cases where the code official has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

110.8 Enforcement in Municipal Court. Civil actions to enforce this code shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of a notice of violation or of an order following a review by the code official is not itself evidence that a violation exists.

110.9 Judicial review. Because civil actions to enforce this code must be brought exclusively in Seattle Municipal Court pursuant to Section 110.8, orders of the code official, including notices of violation issued under this chapter, are not subject to judicial review pursuant to chapter 36.70C RCW.

110.10 Alternative criminal penalty. Anyone who violates or fails to comply with any notice of violation or order issued by the code official pursuant to this code or who removes, mutilates, destroys or conceals a notice issued or posted by the code official shall, upon conviction thereof, be punished by a fine of not more than $5000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

110.11 Additional relief. The code official may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

110.12 Administrative review by the code official. Prior to issuance of the mechanical permit, applicants may request administrative review by the code official of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the code official.

110.13 Administrative review by the Construction Codes Advisory Board. After administrative review by the code official, and prior to issuance of the mechanical permit, applicants may request review of decisions or actions pertaining to the application and interpretation of this code by the Construction Codes Advisory Board according to *International Building Code* Section 103.11, except for stop work orders, notices of violations and revocations of permits. The review will be performed by three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the code official.

110.14 Recording. The code official may record a copy of any order or notice with the Department of Records and Elections of King County.

110.15 Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by Title 22 and this code may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

SECTION 111
RULES OF THE CODE OFFICIAL

111.1 Authority. The code official has authority to issue interpretations of this code and to adopt and enforce rules and regulations supplemental to this code as may be deemed necessary to clarify the application of the provisions of this code. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this code.

111.2 Procedure for adoption of rules. The code official shall promulgate, adopt and issue rules according to the procedures specified in the Administrative Code, Chapter 3.02 of the *Seattle Municipal Code*.

SECTION 112
CONSTRUCTION CODES ADVISORY BOARD

112.1 Construction Codes Advisory Board committee. A committee of the Construction Codes Advisory Board may examine proposed administrative rules and amendments relating to this code and related provisions of other codes and make recommendations to the code official and to the City Council for changes in this code. The committee will be called on as needed by the Construction Codes Advisory Board.

SECTION 113
PERMITS

113.1 Permits required. Except as otherwise specifically provided in this code, a permit shall be obtained from the code official prior to each installation, alteration, repair, replacement or remodel of any equipment or mechanical system regulated by this code. A separate mechanical permit is required for each separate building or structure.

113.2 Work exempt from permit. A mechanical permit is not required for the work listed below.

1. Any portable heating appliance, portable ventilating equipment, or portable cooling unit, if the total capacity of these portable appliances does not exceed 40 percent of the cumulative heating, cooling or ventilating requirements of a building or dwelling unit and does not exceed 3 kW or 10,000 Btu input.
2. Any closed system of steam, hot or chilled water piping within heating or cooling equipment regulated by this code.
3. Minor work or the replacement of any component part of a mechanical system that does not alter its original approval and complies with other applicable requirements of this code.

113.3 Compliance required. All work shall comply with this code, even where no permit is required.

113.4 Flood hazard areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard as defined in Chapter 25.06 of the *Seattle Municipal Code*, subject to additional standards and requirements set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance.

113.5 Emergency repairs. In the case of an emergency, the installation, alteration or repair of any refrigeration system or equipment may be made without a permit, provided that application for a permit is made within the later of 24 hours or one working day from the time when the emergency work was started.

SECTION 114
APPLICATION FOR PERMIT

114.1 Application. To obtain a permit, the applicant shall first file an application in a format determined by the code official. Every such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, property address or similar description that will readily identify and definitely locate the proposed building or work.
3. Provide the contractor's business name, address, phone number and current contractor registration number (required if contractor has been selected).
4. Be accompanied by construction documents, including plans, diagrams, computations and specifications, equipment schedules and other data as required in Sections 114.2 and 114.3.
5. State the valuation of the mechanical work to be done. The valuation of the mechanical work is the estimated current value of all labor and material, whether actually paid for or not, for which the permit is sought.
6. Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority.
7. Give such other data and information as may be required by the code official.
8. State the name of the owner and contractor and the name, address and phone number of a contact person.
9. Substantially conform with applicable law in effect on the date described in Section R101.3, as modified by any exception.

114.2 Construction documents. Construction documents shall be submitted in one or more sets with each application for a permit, or shall be submitted in electronic format determined by the code official. The code official may require plans, computations and specifications to be prepared and designed by an engineer or architect licensed by the state to practice as such. Projects having a total mechanical valuation of $50,000 or larger shall have a mechanical engineering stamp and signature on each sheet.

Exception: A mechanical engineer's stamp or submission of construction documents is not required if the code official finds that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

114.3 Information on construction documents.

114.3.1 Clarity of plans. Plans shall be drawn to a clearly indicated and commonly accepted scale in a format determined by the code official.

114.3.2 Fire-resistive notes. The code official may require that plans for buildings more than two stories in height of other than Group R-3 and Group U occupancies indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing and communication conduits, pipes and similar systems.

114.3.3 Information required on plans. The plans or specifications shall show the following:

1. Layout for each floor with dimensions of all working spaces and a legend of all symbols used.
2. Location, size and material of all piping.
3. Location, size and materials of all air ducts, air inlets and air outlets.
4. Location of all fans, warm-air furnaces, boilers, absorption units, refrigerant compressors and condensers and the weight of all pieces of such equipment weighing 200 pounds or more.
5. Rated capacity or horsepower and efficiency rating of all boilers, warm-air furnaces, heat exchangers, blower fans, refrigerant compressors and absorption units. See also the *International Energy Conservation Code*.
6. Location, size and material of all combustion products vents and chimneys.
7. Location and area of all ventilation and combustion air openings and ducts.
8. Location of all air dampers and fire shutters.
9. The first sheet of each set of plans and specifications shall show the address of the proposed work and the name and address of the owner or lessee of the premises.
10. Architectural drawings, typical envelope cross sections and other drawings or data may be required to support system sizing calculations or other thermal requirements of this code or the *International Energy Conservation Code*.

SECTION 115
APPLICATION REVIEW AND PERMIT ISSUANCE

115.1 Issuance. The application and construction documents shall be reviewed by the code official. The construction documents may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

115.1.1 Issuance of permit. The code official shall issue a permit to the applicant if the code official finds the following:

1. The work described in the construction documents substantially conforms to the requirements of this code and other pertinent laws and ordinances;
2. The fees specified in the *Seattle Municipal Code*, Title 22, Subtitle IX, Permit Fees have been paid; and
3. The applicant has complied with all requirements to be performed prior to issuance of a permit for the work under other pertinent laws, ordinances or regulations or included in a master use permit, or otherwise imposed by the building official.

When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

115.1.2 Compliance with approved construction documents. When the code official issues a permit, the code official shall endorse the permit in writing or in electronic format and stamp the plans "APPROVED." Such approved plans and permit shall not be changed, modified or altered without authorization from the code official, and all work shall be done in accordance with the approved construction documents and permit except as authorized by the code official during field inspection to correct errors or omissions, or as authorized by Section 115.2.

115.2 Revisions to the permit. When changes to the approved work are made during construction, approval of the code official shall be obtained prior to execution. The building or mechanical inspector may approve minor changes for work not reducing the structural strength or fire and life safety of the structure. The building or mechanical inspector shall determine if it is necessary to revise the approved construction documents. If revised plans are required, changes shall be submitted to and approved by the code official, accompanied by fees specified in the *Seattle Municipal Code*, Title 22, Subtitle IX, Permit Fees prior to occupancy. All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits.

Minor changes shall not incur additional fees if these changes do not (1) add to the general scope of work; (2) change the basic design concept; (3) involve major relocation of equipment, ducts, or pipes; (4) substantially alter approved equipment size; or (5) require extensive re-review of the plans and specifications.

115.3 Cancellation of permit applications. Applications may be cancelled if no permit is issued by the earlier of the following: (1) twelve months following the date of application; or (2) sixty days after the date of written notice that the permit is ready to be issued. After cancellation, construction documents may be returned to the applicant or destroyed by the code official.

The code official shall notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted in order to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

115.4 Extensions prior to permit issuance. At the discretion of the code official, applications for projects that require more than 12 months to review and approve may be extended for a period that provides reasonable time to complete the review and approval, but in no case longer than 24 months from the date of the original application. No application may be extended more than once. After cancellation, the applicant shall submit a new application and pay a new fee to restart the permit process.

Notwithstanding other provisions of this code, applications may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes or other causes related to the application that are beyond the applicant's control, or while the applicant is making progress toward issuance of a master use permit.

115.5 Retention of plans. One set of approved plans, which may be on microfilm or in electronic format, shall be retained by the code official. One set of approved plans shall be returned to the applicant and shall be kept at the site of the building or work for use by the inspection personnel at all times when the work authorized is in progress.

115.6 Validity of permit. The issuance or granting of a permit or approval of construction documents shall:

1. Not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or other pertinent laws and ordinances.
2. Not prevent the code official from requiring the correction of errors in the construction documents, or from preventing building operations being carried on thereunder when in violation of this code or of other pertinent laws and ordinances of the City.
3. Not prevent the code official from requiring correction of conditions found to be in violation of this code or other pertinent laws and ordinances of the City, or
4. Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the code official or other administrative authority requiring the correction of any such conditions.

115.7 Expiration of permits. Authority to do the work authorized by a permit expires 18 months from the date of issuance. An approved renewal extends the life of a permit for an additional 18 months from the prior expiration date. An approved reestablishment extends the life of the permit for 18 months from the date the permit expired.

Exceptions:

1. Initial permits for major construction projects that require more than 18 months to complete may be issued for a period that provides reasonable time to complete the work, according to an approved construction schedule. The building official may authorize a permit expiration date not to exceed three years from the date of issuance.
2. The code official may issue permits that expire in less than 18 months if the code official determines a shorter period is appropriate to complete the work.

115.8 Renewal of permits. Permits may be renewed and renewed permits may be further renewed by the code official, if the following conditions are met:

1. Application for renewal is made within the 30 day period immediately preceding the date of expiration of the permit; and
2. If the project has had an associated discretionary Land Use review, and the land use approval has not expired; and
3. If an application for renewal is made more than 18 months after the date of mandatory compliance with a new or revised edition of this code, the permit shall not be renewed unless:
   - 3.1. The code official determines that the permit complies, or is modified to comply with the *Seattle Mechanical, Fuel Gas* and *Energy codes* in effect on the date of application for renewal; or
   - 3.2. The work authorized by the permit is substantially underway and progressing at a rate approved by the building official. "Substantially underway" means that normally required inspections have been approved for work such as foundations, framing, mechanical, insulation and finish work is being completed on a continuing basis; or

3.3. Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes or other extraordinary circumstances related to the work authorized by the permit, beyond the permit holder's control, subject to approval by the code official.

115.9 Reestablishment of expired permits. A new permit is required to complete work if a permit has expired and was not renewed.

Exception: A permit that expired less than one year prior to the date of a request for reestablishment may be reestablished upon approval of the code official if it complies with Items 2 and 3 of Section 115.8. Once re-established the permit will not be considered to have expired. The new expiration date of a re-established permit shall be determined in accordance with Section 115.7.

115.10 Revocation of mechanical permits. Whenever the code official determines there are grounds for revoking a permit, the code official may issue a notice of revocation. The notice of revocation shall identify the reason for the proposed revocation, including, but not limited to, the violations, the conditions violated, and any alleged false or misleading information provided.

115.10.1 Standards for revocation. The code official may revoke a permit if:

1. The code or the permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation; or
2. The permit was obtained with false or misleading information.

115.10.2 Service of notice of revocation. The notice of revocation shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

115.10.3 Effective date of revocation. The code official shall identify in the notice of revocation a date certain on which the revocation will take effect. This date may be stayed pending complete review by the code official pursuant to Section 115.10.4.

115.10.4 Review by the code official for notice of revocation. Any person aggrieved by a notice of revocation may obtain a review by making a request in writing to the code official within three business days of the date of service of the notice of revocation. The review shall occur within five business days after receipt by the building official of the request for review. Any person affected by the notice of revocation may submit additional information to the building official for consideration as part of the review at any time prior to the review.

115.10.4.1 Review procedure. The review will be made by a representative of the code official who will review all additional information received and may also request a site visit. After the review, the code official may:

1. Sustain the notice of revocation and affirm or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Modify the notice of revocation and affirm or modify the date the revocation will take effect; or
4. Continue the review to a date certain.

115.10.4.2 Order of revocation of permit. The code official shall issue an order containing the decision within ten days after the review is completed and shall cause the same to be sent by regular first class mail to the person or persons requesting the review, any other person on whom the notice of revocation was served, and any other person who requested a copy before issuance of the order. The order of the building official is the final order of the City, and the City and all parties shall be bound by the order.

SECTION 116
INSPECTIONS

116.1 General. All construction or work for which a permit is required is subject to inspection by the code official, and certain types of construction shall have special inspections by registered special inspectors specified in Chapter 17 of the *International Building Code*. In addition to the "called" inspections specified above, the code official may make or require any other inspections of any mechanical work to ascertain compliance with the provisions of this code and other laws and ordinances that are enforced by the code official.

116.2 Inspection requests. The owner of the property or the owner's authorized agent, or the person designated by the owner or agent to do the work authorized by a permit shall notify the code official that work requiring inspection as specified in this section and Section 120 is ready for inspection.

116.3 Access for inspection. The permit holder and the person requesting any inspections required by this code shall provide access to and means for proper inspection of such work, including safety equipment required by the Washington Industrial Safety and Health Agency. The work shall remain accessible and exposed for inspection purposes until approved by the code

official. Neither the code official nor the City shall be liable for expense entailed in the required removal or replacement of any material to allow inspection.

116.4 Inspection record. Work requiring a mechanical permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position that allows the code official to conveniently make the required entries regarding inspection of the work. This record shall be maintained in such a position by the permit holder or the permit holder's agent until final approval has been granted by the code official.

116.5 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the code official.

116.5.1 Effect of approval. Approval as a result of an inspection is not approval of any violation of the provisions of this code or of other pertinent laws and ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

116.6 Final inspection. When the installation of a mechanical system is complete, an additional and final inspection shall be made.

116.7 Operation of mechanical equipment. The requirements of this section do not prohibit the operation of any mechanical systems installed to replace existing equipment or fixtures serving an occupied portion of the building in the event a request for inspection of such equipment or fixture has been filed with the code official not more than 48 hours after such replacement work is completed, and before any portion of such mechanical system is concealed by any permanent portion of the building.

116.8 Special investigation. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the code official's permission to proceed, the code official may make a special investigation inspection before a permit is issued for the work. If a special investigation is made, a special investigation fee may be assessed in accordance with the Fee Subtitle.

116.9 Reinspections. The code official may require a reinspection if work for which inspection is called is not complete, required corrections are not made, the inspection record is not properly posted on the work site, the approved plans are not readily available to the inspector, access is not provided on the date for which inspection is requested, if deviations from construction documents that require the approval of the code official have been made without proper approval, or as otherwise required by the code official.

116.9.1 Compliance with Section 104.4. For the purpose of determining compliance with Section 104.4, Maintenance, the code official or the fire chief may cause any structure or system to be reinspected.

116.9.2 Reinspection fee. The code official may assess a reinspection fee as set forth in the *Seattle Municipal Code*, Title 22, Subtitle IX, Permit Fees for any action for which reinspection is required. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

SECTION 117
CONNECTION APPROVAL

117.1 Energy connections. No person shall make connections from a source of energy fuel to a mechanical system or equipment regulated by this code for which a permit is required until approved by the code official.

117.2 Temporary connections. The code official may authorize temporary connection of the mechanical equipment to the source of energy fuel for the purpose of testing the equipment, or for use under a temporary certificate of occupancy.

SECTION 118
FEES

118.1 Fees. A fee for each mechanical permit and for other activities related to the enforcement of this code shall be paid as set forth in the *Seattle Municipal Code,* Title 22, Subtitle IX, Permit Fees.

CHAPTER 2
DEFINITIONS

User note:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purposes of the code.*

SECTION 201 (IFGC)
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code and standard, have the meanings indicated in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

[S] 201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *International Building Code*, *International Fire Code*, *International Mechanical Code* or ((~~*International*~~)) *Uniform Plumbing Code*, such terms shall have meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202
(IFGC) GENERAL DEFINITIONS

[M] ACCESS (TO). That which enables a device, *appliance* or *equipment* to be reached by ready *access* or by a means that first requires the removal or movement of a panel, door or similar obstruction (see also "*Ready access*").

[M] AIR, EXHAUST. Air being removed from any space or piece of *equipment* or *appliance* and conveyed directly to the atmosphere by means of openings or ducts.

[M] AIR, MAKEUP. Any combination of outdoor and transfer air intended to replace exhaust air and exfiltration.

AIR CONDITIONER, GAS-FIRED. A gas-burning, automatically operated *appliance* for supplying cooled air, dehumidified air, or both, or chilled liquid.

[M] AIR CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a conditioned space.

[M] AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

[A] ALTERATION. A change in a system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

ANODELESS RISER. A transition assembly in which plastic *piping* is installed and terminated above ground outside of a building.

[M] APPLIANCE. Any apparatus or device that utilizes a fuel or a raw material as a fuel to produce light, heat, power, refrigeration or air conditioning. Also, an apparatus that compresses fuel gases.

APPLIANCE, AUTOMATICALLY CONTROLLED. *Appliances* equipped with an automatic burner ignition and safety shutoff device and other automatic devices that accomplish complete turn-on and shutoff of the gas to the main burner or burners, and graduate the gas supply to the burner or burners, but do not affect complete shutoff of the gas.

APPLIANCE, FAN-ASSISTED COMBUSTION. An *appliance* equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber or heat exchanger.

APPLIANCE, UNVENTED. An *appliance* designed or installed in such a manner that the products of combustion are not conveyed by a vent or chimney directly to the outside atmosphere.

[M] APPLIANCE, VENTED. An *appliance* designed and installed in such a manner that all of the products of combustion are conveyed directly from the *appliance* to the outdoor atmosphere through an *approved* chimney or vent system.

APPLIANCE TYPE.

Low-heat appliance (residential appliance). Any *appliance* in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of 1,000°F (538°C) or less.

Medium-heat appliance. Any *appliance* in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of more than 1,000°F (538°C), but not greater than 2,000°F (1093°C).

[A] APPROVED. Acceptable to the *code official*.

[A] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing certification, where such agency has been *approved* by the *code official*.

ATMOSPHERIC PRESSURE. The pressure of the weight of air and water vapor on the surface of the earth, approximately 14.7 pounds per square inch (psi) (101 kPa absolute) at sea level.

AUTOMATIC IGNITION. Ignition of gas at the burner(s) when the gas controlling device is turned on, including reignition if the flames on the burner(s) have been extinguished by means other than by the closing of the gas controlling device.

BAFFLE. An object placed in an *appliance* to change the direction of or retard the flow of air, air-gas mixtures or flue gases.

BAROMETRIC DRAFT REGULATOR. A balanced damper device attached to a chimney, vent connector, breeching or flue gas manifold to protect combustion *appliances* by controlling chimney draft. A double-acting barometric draft regulator is one whose balancing damper is free to move in either direction to protect combustion appliances from both excessive draft and backdraft.

**[S] BOILER. ((~~, LOW-PRESSURE.~~ ~~A self-contained *appliance* for supplying steam or hot water.~~)) A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the direct application of heat. The term *boiler* shall also include fire units for heating or vaporizing liquids other than water where these systems are complete within themselves.

((~~**Hot water heating boiler.** A boiler in which no steam is generated, from which hot water is circulated for heating purposes and then returned to the boiler, and that operates at water pressures not exceeding 160 pounds per square inch gauge (psig) (1100 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler *outlet*.~~

~~**Hot water supply boiler.** A boiler, completely filled with water, which furnishes hot water to be used externally to itself, and that operates at water pressures not exceeding 160 psig (1100 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler *outlet*.~~

~~**Steam heating boiler.** A boiler in which steam is generated and that operates at a steam pressure not exceeding 15 psig (100 kPa gauge).~~))

[S] BOILER CODE. The *Seattle Boiler and Pressure Vessel Code*.

BONDING JUMPER. A conductor installed to electrically connect metallic gas *piping* to the grounding electrode system.

[M] BRAZING. A metal-joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 1,000°F (538°C), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary action.

BROILER. A general term including salamanders, barbecues and other *appliances* cooking primarily by radiated heat, excepting toasters.

BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (454 g) of water 1°F (0.56°C) (1 Btu = 1055 J).

BURNER. A device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

Induced-draft. A burner that depends on draft induced by a fan that is an integral part of the *appliance* and is located downstream from the burner.

Power. A burner in which gas, air or both are supplied at pressures exceeding, for gas, the line pressure, and for air, atmospheric pressure, with this added pressure being applied at the burner.

[M] CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from an *appliance* to the outside atmosphere.

Factory-built chimney. A *listed* and *labeled* chimney composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

Metal chimney. A field-constructed chimney of metal.

[M] CLEARANCE. The minimum distance through air measured between the heat-producing surface of the mechanical *appliance*, device or *equipment* and the surface of the *combustible material* or *assembly*.

CLOTHES DRYER. An *appliance* used to dry wet laundry by means of heated air. Dryer classifications are as follows:

Type 1. Factory-built package, multiple production. Primarily used in family living environment. Usually the smallest unit physically and in function output.

Type 2. Factory-built package, multiple production. Used in business with direct intercourse of the function with the public. Not designed for use in individual family living environment.

[S][A] CODE. These regulations, subsequent amendments thereto or any emergency rule or regulation that ((~~the administrative authority having jurisdiction has lawfully~~)) have been adopted.

[S][A] CODE OFFICIAL. The ((~~officer or other designated authority charged with the administration and enforcement of this code,~~)) Director of the Seattle Department of Construction and Inspections or a duly authorized representative.

[M] COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

[M] COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

[M] COMBUSTION. In the context of this code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

[M] COMBUSTION AIR. Air necessary for complete combustion of a fuel, including theoretical air and excess air.

[M] COMBUSTION CHAMBER. The portion of an *appliance* within which combustion occurs.

[M] COMBUSTION PRODUCTS. Constituents resulting from the combustion of a fuel with the oxygen of the air, including inert gases, but excluding excess air.

[M] CONCEALED LOCATION. A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

CONCEALED PIPING. *Piping* that is located in a *concealed location* (see "*Concealed location*").

CONDENSATE. The liquid that condenses from a gas (including flue gas) caused by a reduction in temperature or increase in pressure.

CONNECTOR, APPLIANCE (Fuel). Rigid metallic pipe and fittings, semirigid metallic tubing and fittings or a *listed* and *labeled* device that connects an *appliance* to the gas *piping* system.

CONNECTOR, CHIMNEY OR VENT. The pipe that connects an *appliance* to a chimney or vent.

[A] CONSTRUCTION DOCUMENTS. All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a mechanical permit.

[M] CONTROL. A manual or automatic device designed to regulate the gas, air, water or electrical supply to, or operation of, a mechanical system.

CONVERSION BURNER. A unit consisting of a burner and its controls for installation in an *appliance* originally utilizing another fuel.

COUNTER APPLIANCES. Appliances such as coffee brewers and coffee urns and any appurtenant water-heating *appliance*, food and dish warmers, hot plates, griddles, waffle bakers and other appliances designed for installation on or in a counter.

CUBIC FOOT. The amount of gas that occupies 1 cubic foot (0.02832 m^3) when at a temperature of 60°F (16°C), saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury (101 kPa).

[M] DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

DECORATIVE APPLIANCE, VENTED. A vented *appliance* wherein the primary function lies in the aesthetic effect of the flames.

DECORATIVE APPLIANCES FOR INSTALLATION IN VENTED FIREPLACES. A vented *appliance* designed for installation within the fire chamber of a vented *fireplace*, wherein the primary function lies in the aesthetic effect of the flames.

DEMAND. The maximum amount of gas input required per unit of time, usually expressed in cubic feet per hour, or Btu/h (1 Btu/h = 0.2931 W).

[BS] DESIGN FLOOD ELEVATION. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the *building's* perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

DILUTION AIR. Air that is introduced into a draft hood and is mixed with the flue gases.

[M] JOINT, WELDED. A gas-tight joint obtained by the joining of metal parts in molten state.

[A] LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, *approved* agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the *equipment*, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LEAK CHECK. An operation performed on a gas *piping* system to verify that the system does not leak.

LIMIT CONTROL. A device responsive to changes in pressure, temperature or level for turning on, shutting off or throttling the gas supply to an *appliance*.

LIQUEFIED PETROLEUM GAS or LPG (LP-GAS). Liquefied petroleum gas composed predominately of propane, propylene, butanes or butylenes, or mixtures thereof that is gaseous under normal atmospheric conditions, but is capable of being liquefied under moderate pressure at normal temperatures.

[A] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *code official* and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment*, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

[M] LIVING SPACE. Space within a *dwelling unit* utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOG LIGHTER. A manually operated solid fuel ignition *appliance* for installation in a vented solid fuel-burning *fireplace*.

LUBRICATED PLUG-TYPE VALVE. A valve of the plug and barrel type provided with means for maintaining a lubricant between the bearing surfaces.

MAIN BURNER. A device or group of devices essentially forming an integral unit for the final conveyance of gas or a mixture of gas and air to the combustion zone, and on which combustion takes place to accomplish the function for which the *appliance* is designed.

METER. The instrument installed to measure the volume of gas delivered through it.

MODULATING. Modulating or throttling is the action of a control from its maximum to minimum position in either predetermined steps or increments of movement as caused by its actuating medium.

[M] NONCOMBUSTIBLE MATERIALS. Materials that, where tested in accordance with ASTM E136, have not fewer than three of four specimens tested meeting all of the following criteria:

1. The recorded temperature of the surface and interior thermocouples shall not at any time during the test rise more than 54ºF (30ºC) above the furnace temperature at the beginning of the test.
2. There shall not be flaming from the specimen after the first 30 seconds.
3. If the weight loss of the specimen during testing exceeds 50 percent, the recorded temperature of the surface and interior thermocouples shall not at any time during the test rise above the furnace air temperature at the beginning of the test, and there shall not be flaming of the specimen.

[A] OCCUPANCY. The purpose for which a building, or portion thereof, is utilized or occupied.

[M] OFFSET (VENT). A combination of *approved* bends that makes two changes in direction bringing one section of the vent out of line but into a line parallel with the other section.

ORIFICE. The opening in a cap, spud or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

OUTLET. The point at which a gas-fired *appliance* connects to the gas *piping* system.

OXYGEN DEPLETION SAFETY SHUTOFF SYSTEM (ODS). A system designed to act to shut off the gas supply to the main and pilot burners if the oxygen in the surrounding atmosphere is reduced below a predetermined level.

[S] PERSON. Any individual, receiver, administrator, executor, assignee, trustee in bankruptcy, trust, estate, firm, partnership, joint venture, club, company, joint stock company, business trust, municipal corporation, political subdivision of the State of Washington, corporation, limited liability company, association, society or any group of individuals acting as a unit, whether mutual, cooperative, fraternal, nonprofit or otherwise, and the United States or any instrumentality thereof.

PILOT. A small flame that is utilized to ignite the gas at the main burner or burners.

[M] PIPING. Where used in this code, "*piping*" refers to either pipe or tubing, or both.

Pipe. A rigid conduit of iron, steel, copper, copper-alloy or plastic.

Tubing. Semirigid conduit of copper, copper-alloy aluminum, plastic or steel.

Reseating or self-closing type. An automatic valve that opens and closes a relief vent, depending on whether the temperature is above or below a predetermined value.

RELIEF VALVE, VACUUM. A valve that automatically opens and closes a vent for relieving a vacuum within the hot water supply system, depending on whether the vacuum is above or below a predetermined value.

RISER, GAS. A vertical pipe supplying fuel gas.

ROOM HEATER, UNVENTED. See "*Unvented room heater*."

ROOM HEATER, VENTED. A free-standing heating unit used for direct heating of the space in and adjacent to that in which the unit is located (see "*Vented room heater*").

SAFETY SHUTOFF DEVICE. See "*Flame safeguard*."

SERVICE METER ASSEMBLY. The meter, valve, regulator, piping, fittings and equipment installed by the service gas supplier before the point of delivery.

[BF] SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and the roof.

[A] SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating and either sanitation or kitchen facilities, but not both. Such rooms and spaces that are also part of a *dwelling unit* are not sleeping units.

SPECIFIC GRAVITY. As applied to gas, specific gravity is the ratio of the weight of a given volume to that of the same volume of air, both measured under the same condition.

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages that constitute an automatically operated assembly of integrated systems for generating electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

SYSTEM SHUTOFF. A valve installed after the point of delivery to shut off the entire piping system.

THERMOSTAT.

Electric switch type. A device that senses changes in temperature and controls electrically, by means of separate components, the flow of gas to the burner(s) to maintain selected temperatures.

Integral gas valve type. An automatic device, actuated by temperature changes, designed to control the gas supply to the burner(s) in order to maintain temperatures between predetermined limits, and in which the thermal actuating element is an integral part of the device.

1. Graduating thermostat. A thermostat in which the motion of the valve is approximately in direct proportion to the effective motion of the thermal element induced by the temperature change.
2. Snap-acting thermostat. A thermostat in which the thermostatic valve travels instantly from the closed to the open position, and vice versa.

[P] THIRD-PARTY CERTIFICATION AGENCY. An *approved* agency operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

[P] THIRD-PARTY CERTIFIED. Certification obtained by the manufacturer indicating that the function and performance characteristics of a product or material have been determined by testing and ongoing surveillance by an *approved* third-party certification agency. Assertion of certification is in the form of identification in accordance with the requirements of the third-party certification agency.

[P] THIRD-PARTY TESTED. Procedure by which an *approved* testing laboratory provides documentation that a product, material or system conforms to specified requirements.

TOILET, GAS-FIRED. A packaged and completely assembled appliance containing a toilet that incinerates refuse instead of flushing it away with water.

[M] TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter for joining plastic pipe to steel pipe. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials that cannot be joined directly one to another.

UNIT HEATER. A self-contained, automatically controlled, vented, fuel-gas-burning, space-heating *appliance*, intended for installation in the space to be heated without the use of ducts, and having integral means for circulation of air.

UNLISTED BOILER. A boiler not *listed* by a nationally recognized testing agency.

[S] UNSAFE. Constituting a fire or health hazard or otherwise dangerous to human life, or constituting a hazard to safety, health or public welfare.

VENTING SYSTEM. A continuous open passageway from the flue collar or draft hood of an *appliance* to the outdoor atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

Forced draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

Induced draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Mechanical draft venting system. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure.

Natural draft venting system. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

WALL HEATER, UNVENTED-TYPE. A room heater of the type designed for insertion in or attachment to a wall or partition. Such heater does not incorporate concealed venting arrangements in its construction and discharges all products of combustion through the front into the room being heated.

[S][M] WATER HEATER. Any listed heating *appliance* or *equipment* that heats potable water and supplies such water to the potable hot water distribution system ((-)) excluding any *appliance* or *equipment* that exceeds any of the following:

1. An operating temperature of 210 degrees F (99 degrees C);
2. A maximum allowable working pressure of 160 pounds per square inch (1103 kPa);
3. A volume of 120 gallons (454 L); or
4. A heat input of 200,000 Btu/hr (58.6 kW).

Any *appliance* or *equipment* that exceeds any one of these values is classified as a *boiler*.

CHAPTER 3
GENERAL REGULATIONS

User note:

About this chapter: *Chapter 3 addresses many unrelated topics that would be out of place in other chapters that address specific subjects. Topics include listing and labeling, structural safety, appliance locations, access, combustion air, installation requirements, clearances, electrical bonding and condensate disposal.*

SECTION 301 (IFGC)
GENERAL

[S] 301.1 Scope. This chapter shall govern the approval and installation of all *equipment* and *appliances* that comprise parts of the installations regulated by this code in accordance with Section ((~~101.2~~)) 103.1. See also the *International Fire Code*.

[W][S] 301.1.1 Other fuels. The requirements for combustion and dilution air for gas-fired *appliances* shall be governed by Section 304. The requirements for combustion and dilution air for appliances operating with fuels other than fuel gas shall be regulated by the *International Mechanical Code*. The standards for liquefied petroleum gas installations shall be the 2021 Edition of NFPA 58 (*Liquefied Petroleum Gas Code*) and the 2021 Edition of ANSI Z223.1/NFPA 54 (*National Fuel Gas Code*).

301.2 Energy utilization. Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *International Energy Conservation Code*.

Note: Seattle Energy Code Section C403.1.4 also restricts the use of electric resistance and fossil fuel-fired equipment for HVAC heating in most buildings, and Section C404.2.3 restricts the use of electric resistance and fossil fuel-fired service water heating equipment in Group R-1 and R-2 buildings.

301.3 Listed and labeled. *Appliances* regulated by this code shall be *listed* and *labeled* for the application in which they are used unless otherwise *approved* in accordance with Section 105. The approval of unlisted appliances in accordance with Section 105 shall be based on *approved* engineering evaluation.

301.4 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.4.1 through 301.4.2.3.

301.4.1 Testing. An *approved* agency shall test a representative sample of the *appliances* being *labeled* to the relevant standard or standards. The *approved* agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

301.4.2 Inspection and identification. The *approved* agency shall periodically perform an inspection, which shall be in-plant if necessary, of the *appliances* to be *labeled*. The inspection shall verify that the *labeled* appliances are representative of the appliances tested.

301.4.2.1 Independent. The agency to be *approved* shall be objective and competent. To confirm its objectivity, the agency shall disclose all possible conflicts of interest.

301.4.2.2 Equipment. An *approved* agency shall have adequate *equipment* to perform all required tests. The *equipment* shall be periodically calibrated.

301.4.2.3 Personnel. An *approved* agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

301.5 Label information. A permanent factory-applied nameplate(s) shall be affixed to appliances on which shall appear in legible lettering, the manufacturer's name or trademark, the model number, serial number and, for *listed* appliances, the seal or mark of the testing agency. A label shall include the hourly rating in British thermal units per hour (Btu/h) (W); the type of fuel *approved* for use with the *appliance*; and the minimum *clearance* requirements.

[S] 301.6 Plumbing connections. Potable water supply and building drainage system connections to *appliances* regulated by this code shall be in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

301.7 Fuel types. *Appliances* shall be designed for use with the type of fuel gas that will be supplied to them.

301.7.1 Appliance fuel conversion. Appliances shall not be converted to utilize a different fuel gas except where complete instructions for such conversion are provided in the installation instructions, by the serving gas supplier or by the *appliance* manufacturer.

the addition of loads to any member, such as HVAC *equipment* and water heaters, shall not be permitted without verification that the truss is capable of supporting such additional loading.

[BS] 302.5 Cutting, notching and boring holes in structural steel framing. The cutting, notching and boring of holes in structural steel framing members shall be as prescribed by the *registered design professional*.

[BS] 302.6 Cutting, notching and boring holes in cold-formed steel framing. Flanges and lips of load-bearing, cold-formed steel framing members shall not be cut or notched. Holes in webs of load-bearing, cold-formed steel framing members shall be permitted along the centerline of the web of the framing member and shall not exceed the dimensional limitations, penetration spacing or minimum hole edge distance as prescribed by the *registered design professional*. Cutting, notching and boring holes of steel floor/roof decking shall be as prescribed by the *registered design professional*.

[BS] 302.7 Cutting, notching and boring holes in non-structural cold-formed steel wall framing. Flanges and lips of nonstructural cold-formed steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed 1-1/2 inches (38 mm) in width or 4 inches (102 mm) in length, and the holes shall not be spaced less than 24 inches (610 mm) center to center from another hole or less than 10 inches (254 mm) from the bearing end.

SECTION 303 (IFGC)
APPLIANCE LOCATION

303.1 General. Appliances shall be located as required by this section, specific requirements elsewhere in this code and the conditions of the *equipment* and *appliance* listing.

303.2 Hazardous locations. *Appliances* shall not be located in a *hazardous location* unless *listed* and *approved* for the specific installation.

303.3 Prohibited locations. Appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets or surgical rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following:

1. The *appliance* is a direct-vent *appliance* installed in accordance with the conditions of the listing and the manufacturer's instructions.
2. Vented room heaters, wall furnaces, vented decorative appliances, vented gas fireplaces, vented gas *fireplace* heaters and decorative appliances for installation in vented solid fuel-burning fireplaces are installed in rooms that meet the required volume criteria of Section 304.5.
3. A single wall-mounted unvented room heater is installed in a bathroom and such unvented room heater is equipped as specified in Section 621.6 and has an input rating not greater than 6,000 Btu/h (1.76 kW). The bathroom shall meet the required volume criteria of Section 304.5.
4. A single wall-mounted unvented room heater is installed in a bedroom and such unvented room heater is equipped as specified in Section 621.6 and has an input rating not greater than 10,000 Btu/h (2.93 kW). The bedroom shall meet the required volume criteria of Section 304.5.
5. The *appliance* is installed in a room or space that opens only into a bedroom or bathroom, and such room or space is used for no other purpose and is provided with a solid weather-stripped door equipped with an *approved* self-closing device. *Combustion air* shall be taken directly from the outdoors in accordance with Section 304.6.
6. A clothes dryer is installed in a residential bathroom or toilet room having a permanent opening with an area of not less than 100 square inches (0.06 m^2) that communicates with a space outside of a sleeping room, bathroom, toilet room or storage closet.

303.3.1 Fireplaces and decorative appliances in Group I-2 occupancies. In Group I-2, Condition 2 occupancies, gas *fireplace* appliances and decorative gas appliances shall be prohibited except where such appliances are direct-vent appliances installed in public lobby and waiting areas that are not within smoke compartments containing patient sleeping areas. In Group I-2, Condition 1 occupancies, gas *fireplace* appliances and decorative gas appliances shall be prohibited in patient sleeping rooms. In Group I-2 occupancies, the *appliance* controls shall be located where they can be accessed only by facility staff. Such fireplaces shall comply with Sections 501.2 and 604.1 of this code and Section 915 of the *International Fire Code*.

303.4 Protection from vehicle impact damage. *Appliances* shall not be installed in a location subject to vehicle impact damage except where protected by an *approved* means.

303.5 Indoor locations. Furnaces and boilers installed in closets and alcoves shall be *listed* for such installation.

303.6 Outdoor locations. *Appliances* installed in outdoor locations shall be either *listed* for outdoor installation or provided with protection from outdoor environmental factors that influence the operability, durability and safety of the appliances.

[S] 303.7 Pit locations. Appliances installed in pits or excavations shall not come in direct contact with the surrounding soil. The sides of the pit or excavation shall be held back not less than 12 inches (305 mm) from the *appliance*, and not less than 30

inches (762 mm) on the control side. Where the depth exceeds 12 inches (305 mm) below adjoining grade, the walls of the pit or excavation shall be lined with concrete or masonry, such concrete or masonry shall extend not less than 4 inches (102 mm) above adjoining grade and shall have sufficient lateral load-bearing capacity to resist collapse. The *appliance* shall be protected from flooding in an *approved* manner.

[S][B] 303.8 Installation of pipes or ducts conveying gases, vapors or liquids in elevator hoistways, elevator machine rooms or elevator machinery spaces. Pipes and ducts conveying gases, vapors or liquids are not permitted to be installed in elevator hoistways, elevator machine rooms or elevator machinery spaces.

Exceptions:

1. Only ducts for heating, cooling, ventilating and venting these spaces are permitted to be installed in the elevator hoistway, elevator machine room and elevator machinery space.
2. Ducts and electrical conduit may pass through an elevator machine room or elevator machinery space if they are separated from the room or space by construction equal to the rated construction of the room or space and located so that all required clearances are maintained. If a vented elevator machine room is not vented directly to the outside of the building, the *vent* shall be enclosed within a fire barrier with at least a one-hour fire-resistance rating, or as required for *shafts* where it passes through occupied floors.
3. Subject to the approval of the *code official*, pipes protected with double containment and pipes with threaded or welded joints may be permitted in the elevator hoistway, elevator machine room and elevator machinery space. Pipes shall not be located less than 7 feet (2134 mm) above the floor in machine rooms.

[S][B] 303.9 Interior exit stairways and exit passageways. Mechanical systems shall not be located in interior exit stairways and exit passageways. Penetrations passing entirely through both protective membranes are prohibited.

SECTION 304 (IFGS)
COMBUSTION, VENTILATION AND DILUTION AIR

304.1 General. Air for combustion, ventilation and dilution of flue gases for appliances installed in buildings shall be provided by application of one of the methods prescribed in Sections 304.5 through 304.9. Where the requirements of Section 304.5 are not met, outdoor air shall be introduced in accordance with one of the methods prescribed in Sections 304.6 through 304.9. *Direct-vent appliances*, gas appliances of other than natural draft design, vented gas appliances not designated as Category I and appliances equipped with power burners shall be provided with combustion, ventilation and dilution air in accordance with the *appliance* manufacturer's instructions.

Exception: Type 1 clothes dryers that are provided with makeup air in accordance with Section 614.7.

304.2 Appliance location. Appliances shall be located so as not to interfere with proper circulation of combustion, ventilation and dilution air.

304.3 Draft hood/regulator location. Where used, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the *appliance* served to prevent any difference in pressure between the hood or regulator and the *combustion air* supply.

304.4 Makeup air provisions. Where exhaust fans, clothes dryers and kitchen ventilation systems interfere with the operation of *appliances*, makeup air shall be provided.

304.5 Indoor combustion air. The required volume of indoor air shall be determined in accordance with Section 304.5.1 or 304.5.2, except that where the air infiltration rate is known to be less than 0.40 air changes per hour (ACH), Section 304.5.2 shall be used. The total required volume shall be the sum of the required volume calculated for all *appliances* located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through *combustion air* openings sized and located in accordance with Section 304.5.3, are considered to be part of the required volume.

304.5.1 Standard method. The minimum required volume shall be 50 cubic feet per 1,000 Btu/h (4.8 m^3/kW) of the *appliance* input rating.

304.5.2 Known air-infiltration-rate method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows:

For appliances other than fan-assisted, calculate volume using Equation 3-1.

$$Required\ Volume_{other} \geq \frac{21\ \text{ft}^3}{ACH}\left(\frac{I_{other}}{1{,}000\ \text{Btu/h}}\right) \qquad \textbf{(Equation 3-1)}$$

SECTION 306 (IFGC)
ACCESS AND SERVICE SPACE

[M] 306.1 Access for maintenance and replacement. Appliances, control devices, heat exchangers and HVAC components that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, or any other *piping* or ducts not connected to the *appliance* being inspected, serviced, repaired or replaced. A level working space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be provided in front of the control side to service an *appliance*.

[M] 306.2 Appliances in rooms. Rooms containing appliances shall be provided with a door and an unobstructed passageway measuring not less than 36 inches (914 mm) wide and 80 inches (2032 mm) high.

Exception: Within a *dwelling unit*, appliances installed in a compartment, alcove, basement or similar space shall be provided with *access* by an opening or door and an unobstructed passageway measuring not less than 24 inches (610 mm) wide and large enough to allow removal of the largest *appliance* in the space, provided that a level service space of not less than 30 inches (762 mm) deep and the height of the *appliance*, but not less than 30 inches (762 mm), is present at the front or service side of the *appliance* with the door open.

[M] 306.3 Appliances in attics. Attics containing appliances shall be provided with an opening and unobstructed passageway large enough to allow removal of the largest *appliance*. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the *appliance*. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the *appliance*. The clear *access* opening dimensions shall be not less than 20 inches by 30 inches (508 mm by 762 mm) and large enough to allow removal of the largest *appliance*.

Exceptions:

1. The passageway and level service space are not required where the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is not less than 6 feet (1829 mm) high for its entire length, the passageway shall be not greater than 50 feet (15 250 mm) in length.

[S][M] 306.3.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[M] 306.4 Appliances under floors. Under-floor spaces containing appliances shall be provided with an *access* opening and unobstructed passageway large enough to remove the largest *appliance*. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide, nor more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the *appliance*. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the *appliance*. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending 4 inches (102 mm) above the adjoining grade and having sufficient lateral-bearing capacity to resist collapse. The clear *access* opening dimensions shall be not less than 22 inches by 30 inches (559 mm by 762 mm), and large enough to allow removal of the largest *appliance*.

Exceptions:

1. The passageway is not required where the level service space is present when the *access* is open and the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is not less than 6 feet high (1829 mm) for its entire length, the passageway shall not be limited in length.

[S][M] 306.4.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[S][M] 306.5 Equipment and appliances on roofs or elevated structures. Where *equipment* or *appliances* requiring access ((~~or appliances~~)) are located on an elevated structure or the roof of a building such that personnel will have to climb higher than 16 feet (4877 mm) above grade to access such *equipment* or appliances, an interior or exterior means of access shall be provided. Such access shall not require climbing over obstructions greater than 30 inches (762 mm) in height or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope). Such access shall not require the use of portable ladders.

Permanent ladders installed to provide the required *access* shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than ((~~30~~)) 42 inches (((~~762~~)) 1067 mm).

2. Ladders shall have rung spacing not to exceed ((~~14~~)) 12 inches (((~~356~~)) 305 mm) on center. The upper-most rung shall be not more than 24 inches (610 mm) below the upper edge of the roof hatch, roof or parapet, as applicable.
3. Ladders shall have a toe spacing not less than ((~~6~~)) 7 inches (((~~152~~)) 178 mm) deep.
4. There shall be not less than 18 inches (457 mm) between rails.
5. Rungs shall have a diameter not less than 0.75-inch (19 mm) and be capable of withstanding a 300-pound (136.1 kg) load.
6. Ladders over 30 feet (9144 mm) in height shall be provided with offset sections and landings capable of withstanding 100 pounds per square foot (488.2 kg/m^2). Landing dimensions shall be not less than 18 inches (457 mm) and not less than the width of the ladder served. A guard rail shall be provided on all open sides of the landing.
7. Climbing clearance. The distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be not less than 30 inches (762 mm) measured perpendicular to the rungs. This distance shall be maintained from the point of ladder access to the bottom of the roof hatch. A minimum clear width of 15 inches (381 mm) shall be provided on both sides of the ladder measured from the midpoint of and parallel with the rungs, except where cages or wells are installed.
8. Landing required. The ladder shall be provided with a clear and unobstructed bottom landing area having a minimum dimension of 30 inches by 30 inches (762 mm by 762 mm) centered in front of the ladder.
9. Ladders shall be protected against corrosion by *approved* means.
10. Access to ladders shall be provided at all times.

Interpretation: Item 10 allows access to ladders to be restricted to authorized personnel, and prohibits storage that blocks or restricts access to the ladder.

Catwalks installed to provide the required *access* shall be not less than 24 inches (610 mm) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 *occupancies*.

[M] 306.5.1 Sloped roofs. Where appliances, *equipment*, fans or other components that require service are installed on a roof having a slope of 3 units vertical in 12 units horizontal (25-percent slope) or greater and having an edge more than 30 inches (762 mm) above grade at such edge, a level platform shall be provided on each side of the *appliance* or *equipment* to which *access* is required for service, repair or maintenance. The platform shall be not less than 30 inches (762 mm) in any dimension and shall be provided with guards. The guards shall extend not less than 42 inches (1067 mm) above the platform, shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*. *Access* shall not require walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope). Where *access* involves obstructions greater than 30 inches (762 mm) in height, such obstructions shall be provided with ladders installed in accordance with Section 306.5 or stairways installed in accordance with the requirements specified in the *International Building Code* in the path of travel to and from appliances, fans or *equipment* requiring service.

[S][M] 306.5.2 Electrical requirements. A receptacle outlet shall be provided at or near the *appliance* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[M] 306.6 Guards. Guards shall be provided where various components that require service and roof hatch openings are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof, or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of components that require service and each end of the roof hatch parallel to the roof edge. The top of the guard shall be located not less than 42 inches (1067 mm) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*.

Exception: Guards are not required where permanent fall arrest/restraint anchorage connector devices that comply with ANSI/ASSP Z 359.1 are affixed for use during the entire lifetime of the roof covering. The devices shall be reevaluated for possible replacement when the entire roof covering is replaced. The devices shall be placed not more than 10 feet (3048 mm) on center along hip and ridge lines and placed not less than 10 feet (3048 mm) from roof edges and the open sides of walking surfaces.

SECTION 307 (IFGC)
CONDENSATE DISPOSAL

307.1 Evaporators and cooling coils. Condensate drainage systems shall be provided for *equipment* and *appliances* containing evaporators and cooling coils in accordance with the *International Mechanical Code*.

[S] 307.2 Fuel-burning appliances. Liquid combustion byproducts of condensing appliances shall be collected, pH-neutralized and discharged to an *approved* plumbing fixture or disposal area in accordance with the manufacturer's instructions. Condensate *piping* shall be of *approved* corrosion-resistant material and shall be not smaller than the drain connection on the *appliance*. Such *piping* shall maintain a minimum slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1-percent slope). The termination of concealed condensate *piping* shall be marked to indicate whether the *piping* is connected to the primary drain or to the secondary drain.

[S][M] 307.3 Drain pipe materials and sizes. Components of the condensate disposal system shall be ABS, cast iron, copper and copper alloy, CPVC, cross-linked polyethylene, galvanized steel, PE-RT, polyethylene, polypropylene, PVC or PVDF pipe or tubing. Components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the applicable provisions of Chapter 7 of the ((~~*International*~~)) *Uniform Plumbing Code* relative to the material type. Condensate waste and drain line size shall be not less than 3/4-inch (19 mm) pipe size and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an *approved* method.

307.4 Traps. Condensate drains shall be trapped as required by the *equipment* or *appliance* manufacturer.

307.5 Auxiliary drain pan. Category IV condensing *appliances* shall be provided with an auxiliary drain pan where damage to any building component will occur as a result of stoppage in the condensate drainage system. Such pan shall be installed in accordance with the applicable provisions of Section 307 of the *International Mechanical Code*.

Exception: An auxiliary drain pan shall not be required for appliances that automatically shut down operation in the event of a stoppage in the condensate drainage system.

307.6 Condensate pumps. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the *appliance* or *equipment* served such that when the pump fails, the *appliance* or *equipment* will be prevented from operating. Pumps shall be installed in accordance with the manufacturer's instructions.

SECTION 308 (IFGS)
CLEARANCE REDUCTION

308.1 Scope. This section shall govern the reduction in required clearances to *combustible materials*, including gypsum board, and *combustible assemblies* for chimneys, vents, *appliances*, devices and *equipment*. Clearance requirements for air-conditioning *equipment* and central heating boilers and furnaces shall comply with Sections 308.3 and 308.4.

308.2 Reduction table. The allowable *clearance* reduction shall be based on one of the methods specified in Table 308.2 or shall utilize a reduced *clearance* protective assembly *listed* and *labeled* in accordance with UL 1618. Where required clearances are not listed in Table 308.2, the reduced clearances shall be determined by linear interpolation between the distances listed in the table. Reduced clearances shall not be derived by extrapolation below the range of the table. The reduction of the required clearances to combustibles for *listed* and *labeled* appliances and *equipment* shall be in accordance with the requirements of this section, except that such clearances shall not be reduced where reduction is specifically prohibited by the terms of the *appliance* or *equipment* listing [see Figures 308.2(1) through 308.2(3)].

308.4.5 Clearance from supply ducts. Supply air ducts connecting to *listed* central heating furnaces shall have the same minimum *clearance* to combustibles as required for the furnace supply plenum for a distance of not less than 3 feet (914 mm) from the supply plenum. *Clearance* is not required beyond the 3-foot (914 mm) distance.

SECTION 309 (IFGC)
ELECTRICAL

309.1 Grounding. Gas *piping* shall not be used as a grounding electrode.

[S] 309.2 Connections. Electrical connections between *appliances* and the building wiring, including the grounding of the appliances, shall conform to ((~~NFPA 70~~)) the *Seattle Electrical Code*.

SECTION 310 (IFGS)
ELECTRICAL BONDING

310.1 Pipe and tubing other than CSST. Each aboveground portion of a gas *piping* system other than corrugated stainless steel tubing (CSST) that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas *piping* other than CSST shall be considered to be bonded where it is connected to an *appliance* that is connected to the *equipment* grounding conductor of the circuit that supplies that *appliance*.

310.2 CSST. This section applies to corrugated stainless steel tubing (CSST) that is not listed with an arc-resistant jacket or coating system in accordance with ANSI LC 1/CSA 6.26. CSST gas *piping* systems and *piping* systems containing one or more segments of CSST shall be electrically continuous and bonded to the electrical service grounding electrode system or, where provided, the lightning protection grounding electrode system.

310.2.1 Point of connection. The bonding jumper shall connect to a metallic pipe, pipe fitting or CSST fitting.

310.2.2 Size and material of jumper. The bonding jumper shall be not smaller than 6 AWG copper wire or equivalent.

310.2.3 Bonding jumper length. The length of the bonding jumper between the connection to a gas *piping* system and the connection to a grounding electrode system shall not exceed 75 feet (22 860 mm). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or, where provided, the lightning protection grounding electrode system.

310.2.4 Bonding connections. Bonding connections shall be in accordance with NFPA 70.

310.2.5 Connection devices. Devices used for making the bonding connections shall be *listed* for the application in accordance with UL 467.

310.3 Arc-resistant CSST. This section applies to corrugated stainless steel tubing (CSST) that is *listed* with an arc-resistant jacket or coating system in accordance with ANSI LC 1/CSA 6.26. The CSST shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a *piping* system does not have an arc-resistant jacket or coating system, the bonding requirements of Section 310.2 shall apply. Arc-resistant-jacketed CSST shall be considered to be bonded where it is connected to an *appliance* that is connected to the *appliance* grounding conductor of the circuit that supplies that *appliance*.

TABLE 402.4(33)
CORRUGATED STAINLESS STEEL TUBING (CSST)

Gas	Undiluted Propane
Inlet Pressure	2.0 psi
Pressure Drop	1.0 psi
Specific Gravity	1.50

INTENDED USE: SIZING BETWEEN 2 PSI SERVICE AND THE LINE PRESSURE REGULATOR														
	TUBE SIZE (EHD)													
Flow Designation	**13**	**15**	**18**	**19**	**23**	**25**	**30**	**31**	**37**	**39**	**46**	**48**	**60**	**62**
Length (ft)	**Capacity in Thousands of Btu per Hour**													
10	426	558	927	1,110	1,740	2,170	4,100	4,720	7,130	7,958	15,200	16,800	29,400	34,200
25	262	347	591	701	1,120	1,380	2,560	2,950	4,560	5,147	9,550	10,700	18,800	21,700
30	238	316	540	640	1,030	1,270	2,330	2,690	4,180	4,719	8,710	9,790	17,200	19,800
40	203	271	469	554	896	1,100	2,010	2,320	3,630	4,116	7,530	8,500	14,900	17,200
50	181	243	420	496	806	986	1,790	2,070	3,260	3,702	6,730	7,610	13,400	15,400
75	147	196	344	406	663	809	1,460	1,690	2,680	3,053	5,480	6,230	11,000	12,600
80	140	189	333	393	643	768	1,410	1,630	2,590	2,961	5,300	6,040	10,600	12,200
100	124	169	298	350	578	703	1,260	1,450	2,330	2,662	4,740	5,410	9,530	10,900
150	101	137	245	287	477	575	1,020	1,180	1,910	2,195	3,860	4,430	7,810	8,890
200	86	118	213	248	415	501	880	1,020	1,660	1,915	3,340	3,840	6,780	7,710
250	77	105	191	222	373	448	785	910	1,490	1,722	2,980	3,440	6,080	6,900
300	69	96	173	203	343	411	716	829	1,360	1,578	2,720	3,150	5,560	6,300
400	60	82	151	175	298	355	616	716	1,160	1,376	2,350	2,730	4,830	5,460
500	53	72	135	158	268	319	550	638	1,030	1,237	2,100	2,450	4,330	4,880

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa, 1-inch water column = 0.2488 kPa,
1 British thermal unit per hour = ((~~0.293 1~~)) 0.2931 W, 1 cubic foot per hour = 0.0283 m^3/h, 1 degree = 0.01745 rad.

Notes:

1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 1/2 psi (based on 13 in. w.c. outlet pressure), DO NOT USE THIS TABLE. Consult with the regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator may vary with flow rate.
2. CAUTION: Capacities shown in the table might exceed maximum capacity for a selected regulator. Consult with the regulator or tubing manufacturer for guidance.
3. Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends or fittings shall be increased by an equivalent length of tubing to the following equation: $L = 1.3n$ where L is additional length (feet) of tubing and n is the number of additional fittings or bends.
4. EHD—Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
5. Table entries have been rounded to three significant digits.

TABLE 402.4(37)
POLYETHYLENE PLASTIC TUBING

Gas	Undiluted Propane
Inlet Pressure	11.0 in. w.c.
Pressure Drop	0.5 in. w.c.
Specific Gravity	1.50

INTENDED USE	**PE pipe sizing between integral two-stage regulator at tank or second stage (low-pressure regulator) and building.**	
Plastic Tubing Size (CTS) (inch)		
Nominal OD	**1/2**	**1**
Designation	**SDR 7**	**SDR 11**
Actual ID	**0.445**	**0.927**
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**	
10	121	828
20	83	569
30	67	457
40	57	391
50	51	347
60	46	314
70	42	289
80	39	269
90	37	252
100	35	238
125	31	211
150	28	191
175	26	176
200	24	164
225	22	154
250	21	145
275	20	138
300	19	132
350	18	121
400	16	113
450	15	106
500	15	100

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1-inch water column = 0.2488 kPa,
1 British thermal unit per hour = ((~~0.293 1~~)) 0.2931 W, 1 cubic foot per hour = 0.0283 m^3/h, 1 degree = ((~~0.0 1745~~)) 0.01745 rad.

Note: Table entries have been rounded to three significant digits.

402.4.1 Longest length method. The pipe size of each section of gas *piping* shall be determined using the longest length of *piping* from the *point of delivery* to the most remote *outlet* and the load of the section.

402.4.2 Branch length method. Pipe shall be sized as follows:

1. Pipe size of each section of the longest pipe run from the *point of delivery* to the most remote *outlet* shall be determined using the longest run of *piping* and the load of the section.
2. The pipe size of each section of branch *piping* not previously sized shall be determined using the length of *piping* from the *point of delivery* to the most remote *outlet* in each branch and the load of the section.

402.4.3 Hybrid pressure. The pipe size for each section of higher pressure gas *piping* shall be determined using the longest length of *piping* from the *point of delivery* to the most remote line pressure regulator. The pipe size from the line pressure regulator to each *outlet* shall be determined using the length of *piping* from the regulator to the most remote outlet served by the regulator.

402.5 Noncorrugated stainless steel tubing. Noncorrugated stainless steel tubing shall be sized in accordance with Equations 4-1 and 4-2 of Section 402.4 in conjunction with Section 402.4.1, 402.4.2 or 402.4.3.

403.4.4 Aluminum tubing. Aluminum-alloy tubing shall comply with ASTM B210 or ASTM B241. Aluminum-alloy tubing shall be coated to protect against external corrosion where it is in contact with masonry, plaster or insulation, or is subject to repeated wettings by such liquids as water, detergent or sewage.

Aluminum-alloy tubing shall not be used in exterior locations or underground.

403.4.5 Corrugated stainless steel tubing. Corrugated stainless steel tubing shall be *listed* in accordance with ANSI LC 1/CSA 6.26.

403.5 Plastic pipe, tubing and fittings. Polyethylene plastic pipe, tubing and fittings used to supply fuel gas shall conform to ASTM D2513. Such pipe shall be marked "Gas" and "ASTM D2513."

Polyamide pipe, tubing and fittings shall be identified and conform to ASTM F2945. Such pipe shall be marked "Gas" and "ASTM F2945."

Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing and fittings shall not be used to supply fuel gas.

403.5.1 Anodeless risers. Plastic pipe, tubing and anodeless risers shall comply with the following:

1. Factory-assembled anodeless risers shall be recommended by the manufacturer for the gas used and shall be leak tested by the manufacturer in accordance with written procedures.
2. Service head adapters and field-assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used, and shall be designed and certified to meet the requirements of Category I of ASTM D2513, and U.S. Department of Transportation, Code of Federal Regulations, Title 49, Part 192.281(e). The manufacturer shall provide the user with qualified installation instructions as prescribed by the U.S. Department of Transportation, Code of Federal Regulations, Title 49, Part 192.283(b).

403.5.2 LP-gas systems. The use of plastic pipe, tubing and fittings in undiluted liquefied petroleum gas *piping* systems shall be in accordance with NFPA 58.

403.5.3 Regulator vent piping. Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC conforming to UL 651. PVC vent *piping* shall not be installed indoors.

[S] 403.6 Workmanship and defects. Pipe, tubing and fittings shall be clear and free from cutting burrs and defects in structure or threading, and shall be thoroughly brushed, and chip and scale blown.

Defects in pipe, tubing and fittings shall not be repaired. Defective pipe, tubing and fittings shall be replaced. No gas *piping* shall be strained or pinched, and no *appliance* shall be supported by, or develop any strain or stress on, its supply *piping.*

403.7 Protective coating. Where in contact with material or atmosphere exerting a corrosive action, metallic *piping* and fittings coated with a corrosion-resistant material shall be used. External or internal coatings or linings used on *piping* or components shall not be considered as adding strength.

403.8 Metallic pipe threads. Metallic pipe and fitting threads shall be taper pipe threads and shall comply with ASME B1.20.1.

403.8.1 Damaged threads. Pipe with threads that are stripped, chipped, corroded or otherwise damaged shall not be used. Where a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used.

403.8.2 Number of threads. Field threading of metallic pipe shall be in accordance with Table 403.8.2.

TABLE 403.8.2
SPECIFICATIONS FOR THREADING METALLIC PIPE

IRON PIPE SIZE (inches)	APPROXIMATE LENGTH OF THREADED PORTION (inches)	APPROXIMATE NUMBER OF THREADS TO BE CUT
1/2	3/4	10
3/4	3/4	10
1	7/8	10
1-1/4	1	11
1-1/2	1	11
2	1	11
2-1/2	1-1/2	12
3	1-1/2	12
4	1-5/8	13

For SI: 1 inch = 25.4 mm.

403.8.3 Threaded joint sealing. Threaded joints shall be made using a thread joint sealing material. Thread joint sealing materials shall be nonhardening and shall be resistant to the chemical constituents of the gases to be conducted through the *piping*. Thread joint sealing materials shall be compatible with the pipe and fitting materials on which the sealing materials are used.

403.9 Metallic piping joints and fittings. The type of *piping* joint used shall be suitable for the pressure-temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain the maximum end force caused by the internal pressure and any additional forces caused by temperature expansion or contraction, vibration, fatigue or the weight of the pipe and its contents.

403.9.1 Pipe joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded or assembled with press-connect fittings *listed* in accordance with ANSI L-C4/CSA 6.32. Pipe lighter than Schedule 40 shall be connected using press-connect fittings, flanges, brazing or welding. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1,000°F (538°C). Brazing alloys shall not contain more than 0.05-percent phosphorus.

[S] 403.9.1.1 Welding. All welding in the *piping system* shall be done in accordance with ASME Boiler and Pressure Vessel Code Section IX.

403.9.2 Copper tubing joints. Copper tubing joints shall be assembled with *approved* gas tubing fittings, shall be brazed with a material having a melting point in excess of 1,000°F (538°C) or assembled with press-connect fittings *listed* in accordance with ANSI LC-4/CSA 6.32. Brazing alloys shall not contain more than 0.05-percent phosphorus.

403.9.3 Stainless steel tubing joints. Stainless steel tubing joints shall be welded, assembled with *approved* tubing fittings, brazed with a material having a melting point in excess of 1,000°F (578°C), or assembled with press-connect fittings *listed* in accordance with ANSI LC-4/CSA 6.32.

403.9.4 Flared joints. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints.

403.9.5 Metallic fittings. Metallic fittings shall comply with the following:

1. Threaded fittings in sizes larger than 4 inches (102 mm) shall not be used.
2. Fittings used with steel, stainless steel or wrought-iron pipe shall be steel, stainless steel, copper alloy, malleable iron or cast iron.
3. Fittings used with copper or copper alloy pipe shall be copper or copper alloy.
4. Fittings used with aluminum-alloy pipe shall be of aluminum alloy.
5. Cast-iron fittings:
    5.1. Flanges shall be permitted.
    5.2. Bushings shall not be used.
    5.3. Fittings shall not be used in systems containing flammable gas-air mixtures.
    5.4. Fittings in sizes 4 inches (102 mm) and larger shall not be used indoors except where *approved*.
    5.5. Fittings in sizes 6 inches (152 mm) and larger shall not be used except where *approved*.
6. Aluminum-alloy fittings. Threads shall not form the joint seal.
7. Zinc aluminum-alloy fittings. Fittings shall not be used in systems containing flammable gas-air mixtures.
8. Special fittings. Fittings such as couplings, proprietary-type joints, saddle tees, gland-type compression fittings and flared, flareless and compression-type tubing fittings shall be: used within the fitting manufacturer's pressure-temperature recommendations; used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion and contraction; and shall be *approved*.
9. Where pipe fittings are drilled and tapped in the field, the operation shall be in accordance with all of the following:
    9.1. The operation shall be performed on systems having operating pressures of 5 psi (34.5 kPa) or less.
    9.2. The operation shall be performed by the gas supplier or the gas supplier's designated representative.
    9.3. The drilling and tapping operation shall be performed in accordance with written procedures prepared by the gas supplier.
    9.4. The fittings shall be located outdoors.
    9.5. The tapped fitting assembly shall be inspected and proven to be free of leakage.

403.10 Plastic pipe, joints and fittings. Plastic pipe, tubing and fittings shall be joined in accordance with the manufacturer's instructions. Such joint shall comply with the following:

1. The joint shall be designed and installed so that the longitudinal pull-out resistance of the joint will be greater than or equal to the tensile strength of the plastic *piping* material.
2. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gas-tight joints as strong as or stronger than the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer. Polyethylene heat fusion fittings shall be marked "ASTM D2513." Polyamide heat fusion fittings shall be marked "ASTM F2945."
3. Where compression-type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic *piping* and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the pipe or tubing and shall extend to or beyond the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force-fit in the plastic. Split tubular stiffeners shall not be used.
4. Plastic *piping* joints and fittings for use in liquefied petroleum gas *piping* systems shall be in accordance with NFPA 58.

403.11 Flanges. Flanges and flange gaskets shall comply with Sections 403.11.1 through 403.11.7.

403.11.1 Cast iron. Cast-iron flanges shall be in accordance with ASME B16.1.

403.11.2 Steel. Steel flanges shall be in accordance with ASME B16.5 or ASME B16.47.

403.11.3 Nonferrous. Nonferrous flanges shall be in accordance with ASME B16.24.

403.11.4 Ductile iron. Ductile-iron flanges shall be in accordance with ASME B16.42.

403.11.5 Raised face. Raised face flanges shall not be joined to flat faced cast-iron, ductile-iron or nonferrous material flanges.

403.11.6 Flange facings. Standard facings shall be permitted for use under this code. Where 150-pound (1034 kPa) pressure-rated steel flanges are bolted to Class 125 cast-iron flanges, the raised face on the steel flange shall be removed.

403.11.7 Lapped flanges. Lapped flanges shall be used only above ground or in exposed locations accessible for inspection.

403.12 Flange gaskets. Material for gaskets shall be capable of withstanding the design temperature and pressure of the *piping* system, and the chemical constituents of the gas being conducted, without change to its chemical and physical properties. The effects of fire exposure to the joint shall be considered in choosing material. Acceptable materials include metal (plain or corrugated), composition, aluminum "O" rings, spiral wound metal gaskets, rubber-faced phenolic and elastomeric. Where a flanged joint is opened, the gasket shall be replaced. Full-face flange gaskets shall be used with all nonsteel flanges.

403.12.1 Metallic gaskets. Metallic flange gaskets shall be in accordance with ASME B16.20.

403.12.2 Nonmetallic gaskets. Nonmetallic flange gaskets shall be in accordance with ASME B16.21.

SECTION 404 (IFGC)
PIPING SYSTEM INSTALLATION

404.1 Installation of materials. Materials used shall be installed in strict accordance with the standards under which the materials are accepted and *approved*. In the absence of such installation procedures, the manufacturer's instructions shall be followed. Where the requirements of referenced standards or manufacturer's instructions do not conform to minimum provisions of this code, the provisions of this code shall apply.

404.2 CSST. CSST *piping* systems shall be installed in accordance with the terms of their approval, the conditions of listing, the manufacturer's instructions and this code.

404.3 Prohibited locations. *Piping* shall not be installed in or through a ducted supply, return or exhaust, or a clothes chute, chimney or gas vent, dumbwaiter or elevator shaft. *Piping* installed downstream of the *point of delivery* shall not extend through any townhouse unit other than the unit served by such *piping*.

404.4 Piping in solid partitions and walls. Concealed *piping* shall not be located in solid partitions and solid walls, unless installed in a chase or casing.

404.5 Fittings in concealed locations. Fittings installed in concealed locations shall be limited to the following types:

1. Threaded elbows, tees, and couplings. ((~~, plugs and caps.~~))
2. Brazed fittings.
3. Welded fittings.
4. Fittings *listed* to ANSI LC-1/CSA 6.26 or ANSI LC-4/CSA 6.32.

404.6 Underground penetrations prohibited. Gas *piping* shall not penetrate building foundation walls at any point below grade. Gas *piping* shall enter and exit a building at a point above grade and the annular space between the pipe and the wall shall be sealed.

404.7 Protection against physical damage. Where *piping* will be concealed within light-frame construction assemblies, the *piping* shall be protected against penetration by fasteners in accordance with Sections 404.7.1 through 404.7.3.

Exception: Black steel *piping* and galvanized steel *piping* shall not be required to be protected.

404.7.1 Piping through holes or notches. Where *piping* is installed through holes or notches in framing members and the *piping* is located less than 1-1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the pipe shall be protected by shield plates that cover the width of the pipe and the framing member and that extend not less than 4 inches (102 mm) to each side of the framing member. Where the framing member that the *piping* passes through is a bottom plate, bottom track, top plate or top track, the shield plates shall cover the framing member and extend not less than 4 inches (102 mm) above the bottom framing member and not less than 4 inches (102 mm) below the top framing member.

404.7.2 Piping installed in other locations. Where the *piping* is located within a framing member and is less than 1-1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the *piping* shall be protected by shield plates that cover the width and length of the *piping*. Where the *piping* is located outside of a framing member and is located less than 1-1/2 inches (38 mm) from the nearest edge of the face of the framing member to which the membrane will be attached, the *piping* shall be protected by shield plates that cover the width and length of the *piping*.

404.7.3 Shield plates. Shield plates shall be of steel material having a thickness of not less than 0.0575 inch (1.463 mm) (No. 16 gage).

404.8 Piping in solid floors. *Piping* in solid floors shall be laid in channels in the floor and covered in a manner that will allow *access* to the *piping* with a minimum amount of damage to the building. Where such *piping* is subject to exposure to excessive moisture or corrosive substances, the *piping* shall be protected in an *approved* manner. As an alternative to installation in channels, the *piping* shall be installed in a conduit of Schedule 40 steel, wrought iron, PVC or ABS pipe in accordance with Section 404.8.1 or 404.8.2.

404.8.1 Conduit with one end terminating outdoors. The conduit shall extend into an occupiable portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas *piping* shall be sealed to prevent the possible entrance of any gas leakage. The conduit shall extend not less than 2 inches (51 mm) beyond the point where the pipe emerges from the floor. If the end sealing is capable of withstanding the full pressure of the gas pipe, the conduit shall be designed for the same pressure as the pipe. Such conduit shall extend not less than 4 inches (102 mm) outside the building, shall be vented above grade to the outdoors and shall be installed so as to prevent the entrance of water and insects.

404.8.2 Conduit with both ends terminating indoors. Where the conduit originates and terminates within the same building, the conduit shall originate and terminate in an accessible portion of the building and shall not be sealed. The conduit shall extend not less than 2 inches (51 mm) beyond the point where the pipe emerges from the floor.

404.9 Above-ground outdoor piping. *Piping* installed outdoors shall be elevated not less than 3-1/2 inches (89 mm) above ground and where installed across roof surfaces, shall be elevated not less than 3-1/2 inches (89 mm) above the roof surface. *Piping* installed above ground, outdoors, and installed across the surface of roofs shall be securely supported and located where it will be protected from physical damage. Where passing through an outside wall, the *piping* shall be protected against corrosion by coating or wrapping with an inert material. Where *piping* is encased in a protective pipe sleeve, the annular space between the *piping* and the sleeve shall be sealed.

404.10 Isolation. Metallic *piping* and metallic tubing that conveys fuel gas from an LP-gas storage container shall be provided with an *approved* dielectric fitting to electrically isolate the underground portion of the pipe or tube from the above-ground portion that enters a building. Such dielectric fitting shall be installed above ground, outdoors.

[S] 404.11 Protection against corrosion. Steel pipe or tubing exposed to corrosive action, such as soil conditions or moisture, shall be protected in accordance with Sections 404.11.1 through 404.11.4.

404.11.1 Galvanizing. Zinc coating shall not be deemed adequate protection for underground gas *piping*.

404.11.2 Protection methods. Underground *piping* shall comply with one or more of the following:

1. The *piping* shall be made of corrosion-resistant material that is suitable for the environment in which it will be installed.
2. Pipe shall have a factory-applied, electrically-insulating coating. Fittings and joints between sections of coated pipe shall be coated in accordance with the coating manufacturer's instructions.
3. The *piping* shall have a cathodic protection system installed and the system shall be monitored and maintained in accordance with an *approved* program.

404.18 Pipe debris ((~~romoval~~)) removal. The interior of piping shall be clear of debris. The use of a flammable or combustible gas to clean or remove debris from a *piping* system shall be prohibited.

404.19 Prohibited devices. A device shall not be placed inside the *piping* or fittings that will reduce the cross-sectional area or otherwise obstruct the free flow of gas.

Exceptions:

1. *Approved* gas filters.
2. An *approved* fitting or device where the gas *piping* system has been sized to accommodate the pressure drop of the fitting or device.

404.20 Testing of piping. Before any system of *piping* is put in service or concealed, it shall be tested to ensure that it is gastight. Testing, inspection and purging of *piping* systems shall comply with Section 406.

SECTION 405 (IFGS)
PIPING BENDS AND CHANGES IN DIRECTION

405.1 General. Changes in direction of pipe shall be permitted to be made by the use of fittings, factory bends or field bends.

405.2 Metallic pipe. Metallic pipe bends shall comply with the following:

1. Bends shall be made only with bending tools and procedures intended for that purpose.
2. Bends shall be smooth and free from buckling, cracks or other evidence of mechanical damage.
3. The longitudinal weld of the pipe shall be near the neutral axis of the bend.
4. Pipe shall not be bent through an arc of more than 90 degrees (1.6 rad).
5. The inside radius of a bend shall be not less than six times the outside diameter of the pipe.

405.3 Plastic pipe. Plastic pipe bends shall comply with the following:

1. The pipe shall not be damaged and the internal diameter of the pipe shall not be effectively reduced.
2. Joints shall not be located in pipe bends.
3. The radius of the inner curve of such bends shall be not less than 25 times the inside diameter of the pipe.
4. Where the *piping* manufacturer specifies the use of special bending tools or procedures, such tools or procedures shall be used.

405.4 Elbows. Factory-made welding elbows or transverse segments cut therefrom shall have an arc length measured along the crotch of not less than 1 inch (25 mm) in pipe sizes 2 inches (51 mm) and larger.

SECTION 406 (IFGS)
INSPECTION, TESTING AND PURGING

406.1 General. Prior to acceptance and initial operation, all *piping* installations shall be visually inspected and pressure tested to determine that the materials, design, fabrication and installation practices comply with the requirements of this code.

406.1.1 Inspections. Inspection shall consist of visual examination during or after manufacture, fabrication, assembly or pressure tests.

[S] 406.1.2 Repairs and additions. In the event repairs or additions are made after the pressure test, the affected *piping* shall be tested.

Minor repairs and additions, as determined by the *code official*, are not required to be pressure tested provided that the work is inspected and connections are tested with a noncorrosive leak-detecting fluid or other *approved* leak-detecting methods.

406.1.3 New branches. Where new branches are installed to new *appliances*, only the newly installed branches shall be required to be pressure tested. Connections between the new *piping* and the existing *piping* shall be tested with a noncorrosive leak-detecting fluid or other *approved* leak-detecting methods.

406.1.4 Section testing. A *piping* system shall be permitted to be tested as a complete unit or in sections. A valve in a line shall not be used as a bulkhead between gas in one section of the *piping* system and test medium in an adjacent section, except where a double block and bleed valve system is installed. A valve shall not be subjected to the test pressure unless it can be determined that the valve, including the valve-closing mechanism, is designed to safely withstand the test pressure.

406.1.5 Regulators and valve assemblies. Regulator and valve assemblies fabricated independently of the *piping* system in which they are to be installed shall be permitted to be tested with inert gas or air at the time of fabrication.

406.1.6 Pipe clearing. Prior to testing, the interior of the pipe shall be cleared of all foreign material.

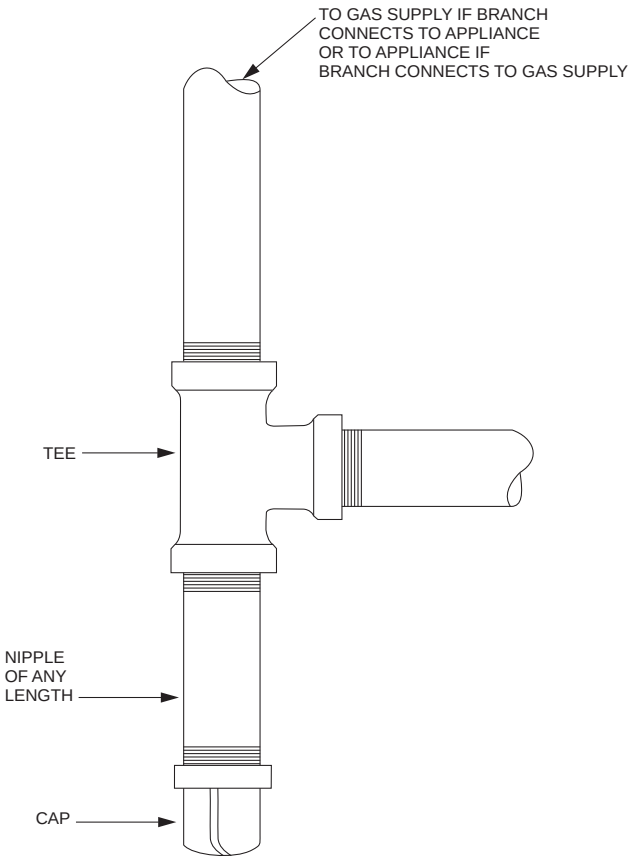


FIGURE 408.4
METHOD OF INSTALLING A TEE FITTING SEDIMENT TRAP

SECTION 409 (IFGC)
SHUTOFF VALVES

409.1 General. *Piping* systems shall be provided with shutoff valves in accordance with this section.

409.1.1 Valve approval. Shutoff valves shall be of an *approved* type; shall be constructed of materials compatible with the *piping*; and shall comply with the standard that is applicable for the pressure and application, in accordance with Table 409.1.1.

[W] TABLE 409.1.1
MANUAL GAS VALVE STANDARDS

VALVE STANDARDS	APPLIANCE SHUTOFF VALVE APPLICATION UP TO 1/2 psig PRESSURE	OTHER VALVE APPLICATIONS			
		UP TO 1/2 psig PRESSURE	UP TO 2 psig PRESSURE	UP TO 5 psig PRESSURE	UP TO 125 psig PRESSURE
ANSI Z21.15/CGA 9.1	X	—	—	—	—
ASME B16.44	X	X	X[a]	X[b]	—
ASME B16.33	X	X	X	X	X
ASME B16.38	—	X	X	X	X

For SI: 1 pound per square inch gauge = 6.895 kPa.
a. If labeled 2G.
b. If labeled 5G.

409.1.2 Prohibited locations. Shutoff valves shall be prohibited in *concealed locations* and *furnace plenums*.

409.1.3 Access to shutoff valves. Shutoff valves shall be located in places so as to provide *access* for operation and shall be installed so as to be protected from damage.

409.2 Meter valve. Every meter shall be equipped with a shutoff valve located on the supply side of the meter.

[S][F] 413.10.2.4 Grounding and bonding. The structure or appurtenance used for supporting the cylinder shall be grounded in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*. The cylinder valve shall be bonded prior to the commencement of venting operations.

[F] 413.10.2.5 Vent tube. A vent tube that will divert the gas flow to the atmosphere shall be installed on the cylinder prior to the commencement of the venting and purging operation. The vent tube shall be constructed of pipe or tubing materials *approved* for use with CNG in accordance with the *International Fire Code*.

The vent tube shall be capable of dispersing the gas not less than 10 feet (3048 mm) above grade level. The vent tube shall not be provided with a rain cap or other feature that would limit or obstruct the gas flow.

At the connection fitting of the vent tube and the CNG cylinder, a *listed* bidirectional detonation flame arrester shall be provided.

[F] 413.10.2.6 Signage. *Approved* "NO SMOKING" signs shall be posted within 10 feet (3048 mm) of the cylinder support structure or appurtenance. *Approved* "CYLINDER SHALL BE BONDED" signs shall be posted on the cylinder support structure or appurtenance.

SECTION 414 (IFGC)
SUPPLEMENTAL AND STANDBY GAS SUPPLY

414.1 Use of air or oxygen under pressure. Where air or oxygen under pressure is used in connection with the gas supply, effective means such as a backpressure regulator and relief valve shall be provided to prevent air or oxygen from passing back into the gas *piping*. Where oxygen is used, installation shall be in accordance with NFPA 51.

414.2 Interconnections for standby fuels. Where supplementary gas for standby use is connected downstream from a meter or a service regulator where a meter is not provided, a device to prevent backflow shall be installed. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose.

SECTION 415 (IFGS)
PIPING SUPPORT INTERVALS

415.1 Interval of support. *Piping* shall be supported at intervals not exceeding the spacing specified in Table 415.1. Spacing of supports for CSST shall be in accordance with the CSST manufacturer's instructions.

TABLE 415.1
SUPPORT OF PIPING

STEEL PIPE, NOMINAL SIZE OF PIPE (inches)	SPACING OF SUPPORTS (feet)	NOMINAL SIZE OF TUBING (SMOOTH-WALL) (inch O.D.)	SPACING OF SUPPORTS (feet)
1/2	6	1/2	4
3/4 or 1	8	5/8 or 3/4	6
1-1/4 or larger (horizontal)	10	7/8 or 1 (horizontal)	8
1-1/4 or larger (vertical)	Every floor level	1 or larger (vertical)	Every floor level

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

SECTION 416 (IFGS)
OVERPRESSURE PROTECTION DEVICES

416.1 Where required. Where the serving gas supplier delivers gas at a pressure greater than 2 psi for *piping* systems serving appliances designed to operate at a gas pressure of 14 inches w.c. or less, overpressure protection devices shall be installed. *Piping* systems serving *equipment* designed to operate at inlet pressures greater than 14 inches w.c. shall be equipped with overpressure protection devices as required by the *appliance* manufacturer's installation instructions.

416.2 Pressure limitation requirements. The requirements for pressure limitation shall be in accordance with Sections 416.2.1 through 416.2.5.

416.2.1 Pressure under 14 inches w.c. Where *piping* systems serving appliances designed to operate with a gas supply pressure of 14 inches w.c. or less are required to be equipped with overpressure protection by Section 416.1, each overpres-

2. Appliances requiring venting shall be permitted to be vented by means of mechanical draft systems of either forced or induced draft design.
3. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to prevent leakage of flue or vent gases into a building.
4. Vent connectors serving appliances vented by natural draft shall not be connected to any portion of mechanical draft systems operating under positive pressure.
5. Where a mechanical draft system is employed, provisions shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the *appliance* for safe performance.

503.3.4 Ventilating hoods and exhaust systems. Where automatically operated appliances, other than commercial cooking appliances, are vented through a ventilating hood or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners only when the damper is open to a position to properly vent the *appliance* and when the power means of exhaust is in operation.

503.3.5 Air ducts and furnace plenums. Venting systems shall not extend into or pass through any fabricated air duct or *furnace plenum.*

503.3.6 Above-ceiling air-handling spaces. Where a venting system passes through an above-ceiling air-handling space or other nonducted portion of an air-handling system, the venting system shall conform to one of the following requirements:

1. The venting system shall be a *listed* special gas vent; other venting system serving a Category III or Category IV *appliance;* or other positive pressure vent, with joints sealed in accordance with the *appliance* or vent manufacturer's instructions.
2. The venting system shall be installed such that fittings and joints between sections are not installed in the above-ceiling space.
3. The venting system shall be installed in a conduit or enclosure with sealed joints separating the interior of the conduit or enclosure from the ceiling space.

503.4 Type of venting system to be used. The type of venting system to be used shall be in accordance with Table 503.4.

TABLE 503.4
TYPE OF VENTING SYSTEM TO BE USED

APPLIANCES	TYPE OF VENTING SYSTEM
Listed Category I appliances Listed appliances equipped with draft hood Appliances listed for use with Type B gas vent	Type B gas vent (Section 503.6) Chimney (Section 503.5) Single-wall metal pipe (Section 503.7) Listed chimney lining system for gas venting (Section 503.5.3) Special gas vent listed for these appliances (Section 503.4.2)
Listed vented wall furnaces	Type B-W gas vent (Sections 503.6, 608)
Category II, Category III and Category IV appliances	As specified or furnished by manufacturers of listed appliances (Sections 503.4.1, 503.4.2)
Incinerators	In accordance with NFPA 82
Appliances that can be converted for use with solid fuel	Chimney (Section 503.5)
Unlisted combination gas and oil-burning appliances	Chimney (Section 503.5)
Listed combination gas and oil-burning appliances	Type L vent (Section 503.6) or chimney (Section 503.5)
Combination gas and solid fuel-burning appliances	Chimney (Section 503.5)
Appliances listed for use with chimneys only	Chimney (Section 503.5)
Unlisted appliances	Chimney (Section 503.5)
Decorative appliances in vented fireplaces	Chimney
Gas-fired toilets	Single-wall metal pipe (Section 626)
Direct-vent appliances	See Section 503.2.3
Appliances with integral vent	See Section 503.2.4

[S] 503.4.1 Plastic piping. Where plastic *piping* is used to vent an *appliance*, the *appliance* shall be *listed* for use with such venting materials and the *appliance* manufacturer's installation instructions shall identify the specific plastic *piping* material. The plastic pipe venting materials and sealants used to connect pipes and fittings in plastic exhausts shall be *labeled* in accordance with the product standards specified by the *appliance* manufacturer and shall be rated to meet or exceed the temperature ratings of the appliance exhaust or shall be *listed* and *labeled* in accordance with UL 1738.

[S] TABLE 503.8
THROUGH-THE-WALL VENT TERMINAL CLEARANCE

FIGURE CLEARANCE	CLEARANCE LOCATION	MINIMUM CLEARANCE FOR DIRECT-VENT TERMINALS	MINIMUM CLEARANCE FOR NONDIRECT-VENT TERMINALS
A	Clearance above finished grade level, veranda, porch, deck, or balcony	12 inches	
B	Clearance to window or door that is openable	6 inches: Appliances ≤ 10,000 Btu/h 9 inches: Appliances > 10,000 Btu/h ≤ 50,000 Btu/h 12 inches: Appliances > 50,000 Btu/h ≤ 150,000 Btu/h Appliances > 150,000 Btu/h, in accordance with the appliance manufacturer's instructions and not less than the clearances specified for nondirect-vent terminals in Row B	4 feet below or to side of opening or 1 foot above opening
C	Clearance to nonopenable window	None unless otherwise specified by the appliance manufacturer	
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet from the centerline of the terminal	None unless otherwise specified by the appliance manufacturer	
E	Clearance to unventilated soffit	None unless otherwise specified by the appliance manufacturer	
F	Clearance to outside corner of building	None unless otherwise specified by the appliance manufacturer	
G	Clearance to inside corner of building	None unless otherwise specified by the appliance manufacturer	
H	Clearance to each side of centerline extended above regulator vent outlet	3 feet up to a height of 15 feet above the regulator vent outlet	
I	Clearance to service regulator vent outlet in all directions	3 feet for gas pressures up to 2 psi; 10 feet for gas pressures above 2 psi	
J	Clearance to nonmechanical air supply inlet to building and the combustion air inlet to any other appliance	Same clearance as specified for Row B	
K	Clearance to a mechanical air supply inlet	10 feet horizontally from inlet or 3 feet above inlet	
L	Clearance above paved sidewalk or paved driveway located on public property	7 feet and shall not be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard	
M	Clearance to underside of veranda, porch, deck, or balcony	12 inches where the area beneath the veranda, porch, deck or balcony is open on not less than two sides. The vent terminal is prohibited in this location where only one side is open.	
N	Clearance of exit terminals of mechanical draft systems above finished ground level	7 feet where located adjacent to public walkways and not less than 10 feet from lot lines or adjacent buildings.	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 Btu/h = 0.293 W.

[M] 614.5 Dryer exhaust duct power ventilators. Domestic dryer exhaust duct power ventilators shall be listed and *labeled* to UL 705 for use in dryer exhaust duct systems. The dryer exhaust duct power ventilator shall be installed in accordance with the manufacturer's instructions.

[M] 614.6 Booster fans prohibited. Domestic booster fans shall not be installed in dryer exhaust systems.

[M] 614.7 Makeup air. Installations exhausting more than 200 cfm (0.09 m^3/s) shall be provided with makeup air.

[M] 614.7.1 Closet installation. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches (645 mm^2) for makeup air shall be provided in the closet enclosure, or makeup air shall be provided by other approved means.

[M] 614.8 Protection required. Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 1-1/4 inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, shall have a minimum thickness of 0.062 inch (1.6 mm) and shall extend not less than 2 inches (51 mm) above sole plates and below top plates.

[M] 614.9 Domestic clothes dryer exhaust ducts. Exhaust ducts for domestic clothes dryers shall conform to the requirements of Sections 614.9.1 through 614.9.6.

[M] 614.9.1 Material and size. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal not less than 0.016 inch (0.4 mm) in thickness. The exhaust duct size shall be 4 inches (102 mm) nominal in diameter.

[M] 614.9.2 Duct installation. Exhaust ducts shall be supported at 4-foot (1219 mm) intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude more than 1/8 inch (3.2 mm) into the inside of the duct. Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation.

[M] 614.9.3 Transition ducts. Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is *listed* and *labeled* in accordance with UL 2158A. Transition ducts shall be not more than 8 feet (2438 mm) in length, and shall not be concealed within construction.

[M] 614.9.4 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Sections 614.9.1 through 614.9.4.3.

[M] 614.9.4.1 Specified length. The maximum length of the exhaust duct shall be 35 feet (10 668 mm) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are utilized, the maximum length of the exhaust duct shall be reduced in accordance with Table 614.9.4.1.

[M] TABLE 614.9.4.1
DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH

DRYER EXHAUST DUCT FITTING TYPE	EQUIVALENT LENGTH
4-inch radius mitered 45-degree elbow	2 feet, 6 inches
4-inch radius mitered 90-degree elbow	5 feet
6-inch radius smooth 45-degree elbow	1 foot
6-inch radius smooth 90-degree elbow	1 foot, 9 inches
8-inch radius smooth 45-degree elbow	1 foot
8-inch radius smooth 90-degree elbow	1 foot, 7 inches
10-inch radius smooth 45-degree elbow	9 inches
10-inch radius smooth 90-degree elbow	1 foot, 6 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

[S][M] 614.9.4.2 Manufacturer's instructions. The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The *code official* shall be provided with a copy of the installation instructions for the make and model of the dryer. Where the exhaust duct is to be concealed, the installation instructions shall be provided to the *code official* prior to the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table 614.9.1 shall be utilized.

Exception: The maximum length of the duct may be increased in an engineered exhaust system when a listed and labeled dryer exhaust booster fan is installed in accordance with the manufacturer's installation instructions.

[M] 614.9.4.3 Dryer exhaust duct power ventilator length. The maximum length of the exhaust duct shall be determined by the dryer exhaust duct power ventilator manufacturer's installation instructions.

[M] 614.9.5 Length identification. Where the exhaust duct equivalent length exceeds 35 feet (10 668 mm), the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet (1829 mm) of the exhaust duct connection.

615.6.1 Timers. A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

615.7 Sauna room. A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

615.7.1 Warning notice. The following permanent notice, constructed of *approved* material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 1/4 inch (6.4 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

SECTION 616 (IFGC)
ENGINE AND GAS TURBINE-POWERED EQUIPMENT

616.1 Powered equipment. Permanently installed *equipment* powered by internal combustion engines and turbines shall be installed in accordance with the manufacturer's instructions and NFPA 37. Stationary engine generator assemblies shall meet the requirements of UL 2200.

616.2 Gas supply connection. *Equipment* powered by internal combustion engines and turbines shall not be rigidly connected to the gas supply *piping*.

SECTION 617 (IFGC)
POOL AND SPA HEATERS

617.1 General. Pool and spa heaters shall be *listed* in accordance with ANSI Z21.56/CSA 4.7 and shall be installed in accordance with the manufacturer's instructions.

[S] SECTION 618 (IFGC)
((~~FORCED-AIR WARM-AIR FURNACES~~))
AIR-HANDLING UNITS

618.1 General. Forced-air warm-air furnaces shall be *listed* in accordance with ANSI Z21.47/CSA 2.3 or UL 795 and shall be installed in accordance with the manufacturer's instructions.

618.2 Dampers. Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

[S] 618.3 Prohibited sources. Outdoor or return air for forced-air heating and cooling systems shall not be taken from the following locations:

1. Closer than 10 feet (3048 mm) from an *appliance* vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 3 feet (914 mm) above the outside air inlet.
2. Where there is the presence of objectionable odors, fumes or flammable vapors; or where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway; or where located at grade level by a sidewalk, street, alley or driveway.
3. A hazardous or insanitary location or a refrigeration machinery room as defined in the *International Mechanical Code*.
4. A room or space, the volume of which is less than 25 percent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with this code, adjoining rooms or spaces shall be considered to be a single room or space for the purpose of determining the volume of such rooms or spaces.

   Exception: The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.
5. A room or space containing an *appliance* where such a room or space serves as the sole source of return air.

   Exception: This shall not apply where:

   1. The *appliance* is a direct-vent *appliance* or an *appliance* not requiring a vent in accordance with Section 501.8.

2. The room or space complies with the following requirements:
   2.1. The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.
   2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.
   2.3. Return-air inlets shall not be located within 10 feet (3048 mm) of a draft hood in the same room or space or the combustion chamber of any atmospheric burner *appliance* in the same room or space.
3. Rooms or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.

6. A closet, bathroom, toilet room, kitchen, garage, boiler room, furnace room or unconditioned attic.

   Exceptions:

   1. Where return air intakes are located not less than 10 feet (3048 mm) from cooking appliances and serve only the kitchen area, taking return air from a kitchen area shall not be prohibited.
   2. Dedicated forced air systems serving only a garage shall not be prohibited from obtaining return air from the garage.

7. A crawl space. ((~~by means of direct connection to the return side of a forced-air system. Transfer openings in the crawl space enclosure shall not be prohibited.~~))

618.4 Screen. Required outdoor air inlets for residential portions of a building shall be covered with a screen having 1/4-inch (6.4 mm) openings. Required outdoor air inlets serving a nonresidential portion of a building shall be covered with screen having openings larger than 1/4 inch (6.4 mm) and not larger than 1 inch (25 mm).

618.5 Return-air limitation. Return air from one *dwelling unit* shall not be discharged into another *dwelling unit*.

618.6 (IFGS) Furnace plenums and air ducts. Where a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside of the space containing the furnace, the return air shall be handled by a duct(s) sealed to the furnace casing and terminating outside of the space containing the furnace. Return air shall not be taken from the mechanical room containing the furnace.

SECTION 619 (IFGC)
CONVERSION BURNERS

619.1 Conversion burners. The installation of conversion burners shall conform to ANSI Z21.8.

SECTION 620 (IFGC)
UNIT HEATERS

620.1 General. Unit heaters shall be *listed* in accordance with ANSI Z83.8/CSA 2.6 and shall be installed in accordance with the manufacturer's instructions.

620.2 Support. Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of *noncombustible material*.

620.3 Ductwork. Ducts shall not be connected to a unit heater unless the heater is *listed* for such installation.

620.4 Clearance. Suspended-type unit heaters shall be installed with clearances to *combustible materials* of not less than 18 inches (457 mm) at the sides, 12 inches (305 mm) at the bottom and 6 inches (152 mm) above the top where the unit heater has an internal draft hood or 1 inch (25 mm) above the top of the sloping side of the vertical draft hood.

Floor-mounted-type unit heaters shall be installed with clearances to *combustible materials* at the back and one side only of not less than 6 inches (152 mm). Where the flue gases are vented horizontally, the 6-inch (152 mm) *clearance* shall be measured from the draft hood or vent instead of the rear wall of the unit heater. Floor-mounted-type unit heaters shall not be installed on combustible floors unless *listed* for such installation.

Clearances for servicing all unit heaters shall be in accordance with the manufacturer's installation instructions.

Exception: Unit heaters *listed* for reduced *clearance* shall be permitted to be installed with such clearances in accordance with their listing and the manufacturer's instructions.

620.5 (IFGS) Installation in commercial garages and aircraft hangars. Unit heaters installed in garages for more than three motor vehicles or in aircraft hangars shall be installed in accordance with Sections 305.9, 305.10 and 305.11.

1. The underside of the *combustible material* or metal cabinet above the cooking top is protected with not less than 1/4-inch (6.4 mm) insulating millboard covered with sheet metal not less than 0.0122 inch (0.3 mm) thick.
2. A metal ventilating hood constructed of sheet metal not less than 0.0122 inch (0.3 mm) thick is installed above the cooking top with a *clearance* of not less than 1/4 inch (6.4 mm) between the hood and the underside of the *combustible material* or metal cabinet. The hood shall have a width not less than the width of the *appliance* and shall be centered over the *appliance.*
3. A cooking *appliance* or microwave oven is installed over a cooking *appliance* and in compliance with the terms of the manufacturer's installation instructions for the upper appliance.

SECTION 624 (IFGC)
WATER HEATERS

[S] 624.1 General. Water heaters shall be ((~~*listed* in accordance with ANSI Z21.10.1/CSA 4.1 or ANSI Z21.10.3/CSA 4.3 and shall be installed in accordance with the manufacturer's instructions~~)) installed in accordance with the *Uniform Plumbing Code* and *Seattle Electrical Code*.

((~~Water heaters utilizing fuels other than fuel gas shall be regulated by the *International Mechanical Code*.~~

~~624.1.1 Installation requirements.~~ ~~The requirements for water heaters relative to sizing, relief valves, drain pans and scald protection shall be in accordance with the *International Plumbing Code*.~~))

[S] ((~~624.2 Water heaters utilized for space heating.~~ ~~Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be *listed* and *labeled* for such applications by the manufacturer and shall be installed in accordance with the manufacturer's instructions and the *International Plumbing Code*.~~))

SECTION 625 (IFGC)
REFRIGERATORS

625.1 General. Refrigerators shall be *listed* in accordance with ANSI Z21.19/CSA 1.4 and shall be installed in accordance with the manufacturer's instructions.

Refrigerators shall be provided with adequate clearances for ventilation at the top and back, and shall be installed in accordance with the manufacturer's instructions. If such instructions are not available, not less than 2 inches (51 mm) shall be provided between the back of the refrigerator and the wall and not less than 12 inches (305 mm) above the top.

SECTION 626 (IFGC)
GAS-FIRED TOILETS

626.1 General. Gas-fired toilets shall be tested in accordance with ANSI Z21.61 and installed in accordance with the manufacturer's instructions.

626.2 Clearance. A gas-fired toilet shall be installed in accordance with its listing and the manufacturer's instructions, provided that the *clearance* shall in any case be sufficient to afford ready *access* for use, cleanout and necessary servicing.

SECTION 627 (IFGC)
AIR-CONDITIONING APPLIANCES

627.1 General. Gas-fired air-conditioning *appliances* shall be *listed* in accordance with ANSI Z21.40.1/CGA 2.91 or ANSI Z21.40.2/CGA 2.92 and shall be installed in accordance with the manufacturer's instructions.

627.2 Independent piping. Gas *piping* serving heating *appliances* shall be permitted to also serve cooling appliances where such heating and cooling appliances cannot be operated simultaneously (see Section 402).

627.3 Connection of gas engine-powered air conditioners. To protect against the effects of normal vibration in service, gas engines shall not be rigidly connected to the gas supply *piping.*

627.4 Clearances for indoor installation. Air-conditioning *appliances* installed in rooms other than alcoves and closets shall be installed with clearances not less than those specified in Section 308.3 except that air-conditioning appliances *listed* for installation at lesser clearances than those specified in Section 308.3 shall be permitted to be installed in accordance with such listing and the manufacturer's instructions and air-conditioning appliances *listed* for installation at greater clearances than those specified in Section 308.3 shall be installed in accordance with such listing and the manufacturer's instructions.

Air-conditioning appliances installed in rooms other than alcoves and closets shall be permitted to be installed with reduced clearances to *combustible material*, provided that the *combustible material* is protected in accordance with Table 308.2.

SECTION 630 (IFGC)
INFRARED RADIANT HEATERS

630.1 General. Infrared radiant heaters shall be *listed* in accordance with ANSI Z83.19 or Z83.20 and shall be installed in accordance with the manufacturer's instructions.

630.2 Support. Infrared radiant heaters shall be fixed in a position independent of gas and electric supply lines. Hangers and brackets shall be of *noncombustible material*.

630.3 (IFGS) Combustion and ventilation air. Where unvented infrared heaters are installed, natural or mechanical means shall provide outdoor ventilation air at a rate of not less than 4 cfm per 1,000 Btu/h (0.38 m^3/min/kW) of the aggregate input rating of all such heaters installed in the space. Exhaust openings for removing flue products shall be above the level of the heaters.

630.4 (IFGS) Installation in commercial garages and aircraft hangars. Overhead infrared heaters installed in garages for more than three motor vehicles or in aircraft hangars shall be installed in accordance with Sections 305.9, 305.10 and 305.11.

SECTION 631 (IFGC)
BOILERS

[S] 631.1 Standards. Boilers shall ((~~be *listed* in accordance with the requirements of ANSI Z21.13/CSA 4.9 or UL 795~~)) comply with the *Seattle Boiler and Pressure Vessel Code*. ((~~If applicable, the boiler shall be designed and constructed in accordance with the requirements of ASME CSD-1 and as applicable, the ASME Boiler and Pressure Vessel Code, Sections I, II, IV, V and IX and NFPA 85.~~))

[S] ((~~631.2 Installation.~~ ~~In addition to the requirements of this code, the installation of boilers shall be in accordance with the manufacturer's instructions and the *International Mechanical Code*. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer. A complete control diagram together with complete boiler operating instructions shall be furnished by the installer. The manufacturer's rating data and the nameplate shall be attached to the boiler.~~))

[S] ((~~631.3 Clearance to combustible materials.~~ ~~Clearances to *combustible materials* shall be in accordance with Section 308.4.~~))

[S] SECTION 632 (IFGC)
((~~EQUIPMENT INSTALLED IN EXISTING UNLISTED BOILERS~~))
RESERVED

((~~**632.1 General.** Gas *equipment* installed in existing unlisted boilers shall comply with Section 631.1 and shall be installed in accordance with the manufacturer's instructions and the *International Mechanical Code*.~~))

SECTION 633 (IFGC)
STATIONARY FUEL-CELL POWER SYSTEMS

[F] 633.1 General. Stationary fuel-cell power systems having a power output not exceeding 10 MW shall be tested in accordance with ANSI/CSA FC 1 and shall be installed in accordance with the manufacturer's instructions, NFPA 853, the *International Building Code* and the *International Fire Code*.

SECTION 634 (IFGC)
GASEOUS HYDROGEN SYSTEMS

634.1 Installation. The installation of gaseous hydrogen systems shall be in accordance with the applicable requirements of this code, the *International Fire Code* and the *International Building Code*.

SECTION 635 (IFGC)
OUTDOOR DECORATIVE APPLIANCES

635.1 General. Permanently fixed-in-place outdoor decorative *appliances* shall be *listed* in accordance with ANSI Z21.97 and shall be installed in accordance with the manufacturer's instructions.

Exception: A locked-open shutoff valve on containers equipped with multiple pressure relief device installations where the arrangement of the valves provides the full required flow through the minimum number of required relief devices at all times.

[F] 703.3.2 Installation. Valves and other mechanical restrictions shall not be located between the pressure relief device and the point of release to the atmosphere.

[F] 703.3.3 Containers. Containers shall be provided with pressure relief devices in accordance with the ASME Boiler and Pressure Vessel Code (Section VIII), DOTn 49 CFR, Parts 100-180 and Section 703.3.7.

[F] 703.3.4 Vessels other than containers. Vessels other than containers shall be protected with pressure relief devices in accordance with the ASME Boiler and Pressure Vessel Code (Section VIII), or DOTn 49 CFR, Parts 100-180.

[F] 703.3.5 Sizing. Pressure relief devices shall be sized in accordance with the specifications to which the container was fabricated. The relief device shall be sized to prevent the maximum design pressure of the container or system from being exceeded.

[F] 703.3.6 Protection. Pressure relief devices and any associated vent *piping* shall be designed, installed and located so that their operation will not be affected by water or other debris accumulating inside the vent or obstructing the vent.

[F] 703.3.7 Access. Pressure relief devices shall be located such that they are provided with ready *access* for inspection and repair.

[F] 703.3.8 Configuration. Pressure relief devices shall be arranged to discharge unobstructed in accordance with Section 2309 of the *International Fire Code*. Discharge shall be directed to the outdoors in such a manner as to prevent impingement of escaping gas on personnel, containers, *equipment* and adjacent structures and to prevent introduction of escaping gas into enclosed spaces. The discharge shall not terminate under eaves or canopies.

Exception: This section shall not apply to DOTn-specified containers with an internal volume of 2 cubic feet (0.057 m^3) or less.

[F] 703.4 Venting. Relief device vents shall be terminated in an *approved* location in accordance with Section 2309 of the *International Fire Code*.

[F] 703.5 Security. Compressed gas containers, cylinders, tanks and systems shall be secured against accidental dislodgement in accordance with Chapter 53 of the *International Fire Code*.

[S][F] 703.6 Electrical wiring and equipment. Electrical wiring and *equipment* shall comply with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

SECTION 704 (IFGC)
PIPING, USE AND HANDLING

704.1 Applicability. Use and handling of containers, cylinders, tanks and hydrogen gas systems shall comply with this section. Gaseous hydrogen systems, *equipment* and machinery shall be *listed* or *approved*.

704.1.1 Controls. Compressed gas system controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls shall be designed to be fail safe in accordance with accepted engineering practice.

704.1.2 Piping systems. *Piping*, tubing, valves and fittings conveying gaseous hydrogen shall be designed and installed in accordance with Sections 704.1.2.1 through 704.1.2.5.1, Chapter 50 of the *International Fire Code*, and ASME B31.12. Cast-iron pipe, valves and fittings shall not be used.

704.1.2.1 Sizing. Gaseous hydrogen *piping* shall be sized in accordance with *approved* engineering methods.

704.1.2.2 Identification of hydrogen piping systems. Hydrogen *piping* systems shall be marked in accordance with ANSI A13.1. Markings used for *piping* systems shall consist of the name of the contents and shall include a direction-of-flow arrow. Markings shall be provided at all of the following locations:

1. At each valve.
2. At wall, floor and ceiling penetrations.
3. At each change of direction.
4. At intervals not exceeding 20 feet (6096 mm).

704.1.2.3 Piping design and construction. *Piping* and tubing materials shall be 300 series stainless steel or materials *listed* or *approved* for hydrogen service and the use intended through the full range of operating conditions to which they will be subjected. *Piping* systems shall be designed and constructed to provide allowance for expansion, contraction, vibration, settlement and fire exposure.

IFGC/IFGS CHAPTER 8

REFERENCED STANDARDS

User note:

About this chapter: *Chapter 8 lists the full title, edition year and address of the promulgator for all standards that are referenced in the code. The section numbers in which the standards are referenced are also listed.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.

ANSI

American National Standards Institute
25 West 43rd Street 4th Floor
New York, NY 10036

ANSI A13.1—2020: Scheme for the Identification of Piping Systems
704.1.2.2

ANSI FC 1—2014: Fuel cell technologies - Part 3-100: Stationary Fuel Power Systems—Safety
633.1

ANSI LC-4/CSA 6.32—2012: Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems
403.9.1, 403.9.2, 403.9.3

ANSI Z21.90/CSA 6.24—2015: Gas Convenience Outlets and Optional Enclosures
411.1

CSA/ANSI NGV 5.1—2016: Residential Fueling Appliances
413.2.3, 413.4

CSA/ANSI NGV 5.2—2017: Vehicle Fueling Appliances (VFA)
413.2.4, 413.5

ANSI LC 1—((~~2016~~)) 2018/CSA 6.26—((~~2016~~)) 2018: Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing
403.4.5

ANSI Z21.1—2016/CSA 1.1—2016: Household Cooking Gas Appliances
623.1

Z21.5.1/CSA 7.1—2017: Gas Clothes Dryers—Volume I—Type 1 Clothes Dryers
613.1

Z21.5.2—2016/CSA 7.2—2016: Gas Clothes Dryers—Volume II—Type 2 Clothes Dryers
613.1, 614.3

Z21.8—94 (R2012): Installation of Domestic Gas Conversion Burners
619.1

Z21.10.1/CSA 4.1—2017: Gas Water Heaters—Volume I—Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
624.1

Z21.10.3/CSA 4.3—2017: Gas Water Heaters—Volume III—Storage, Water Heaters with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous
624.1

ANSI Z21.11.2—2016: Gas-Fired Room Heaters, Volume II, Unvented Room Heaters
621.1

ANSI Z21.13—2017/CSA 4.9—2017: Gas-fired Low-pressure Steam and Hot Water Boilers
631.1

ANSI Z21.15—2009/CSA 9.1—2009 (2014): Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
Table 409.1.1

ANSI Z21.19—2014/CSA 1.4—2014: Refrigerators Using Gas Fuel
625.1

ANSI Z21.24—2015/CSA 6.10—2015: Connectors for Gas Appliances
411.1, 411.3

ANSI—continued

Z83.19—09(R2014): Gas-fired High-Intensity Infrared Heaters
630.1

ANSI Z83.20—2016/CSA 2.34—2016: Gas-Fired Tubular and Low-Intensity
630.1

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

B1.20.1—2019: Pipe Threads, General Purpose (inch)
403.8

B16.1—2020: Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250
403.11.1

B16.5—2019: Pipe Flanges and Flanged Fittings: NPS 1/2 through NFPS 24 Metric/Inch Standard
403.11.2

B16.20—2017: Metallic Gaskets For Pipe Flanges: Ring-Joint, Spiral-Wound and Jacketed
403.12.1

B16.21—2016: Nonmetallic Flat Gaskets for Pipe Flanges
403.12.2

B16.24—2021: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500
403.11.3

B16.33—2012(2017): Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes 1/2 through 2)
Table 409.1.1

B16.38-2012(R2017): Large Metallic Valves for Gas Distribution: Manually Operated, NPS 2 1/2 (DN 65) to NPS 12 (DN 300), 125 psig (8.6 bar) Maximum
Table 409.1.1

B16.42—2021: Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
403.11.4

B16.44—2017: Manually Operated Metallic Gas Valves for Use in Aboveground Piping Systems up to 5 psi
Table 409.1.1

B16.47—2020: Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard
403.11.2

B31.3—2020: Process Piping
704.1.2.4

B31.12—2019: Hydrogen Piping and Pipelines
704.1.2, 704.1.2.4, 705.2, 705.3

B36.10M—2018: Welded and Seamless Wrought-steel Pipe
403.3.2

BPVC—2019: ASME Boiler & Pressure Vessel Code
631.1, 703.2.2, 703.3.3, 703.3.4

CSD-1—2021: Controls and Safety Devices for Automatically Fired Boilers
631.1

ASSP

American Society of Safety Professionals
520 N. Northwest Highway
Park Ridge, IL 60068

Z359.1: The Fall Protection Code
306.6

CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

ANSI/CSA FC1—2014Fuel Cell Technologies—Part 3-100; Stationary Fuel Cell Power Systems—Safety
633.1

ANSI/CSA NGV 5.1—2016: Residential Fueling Appliances
413.2.3, 413.2.4, 413.4

CSA 8—93: Requirements for Gas-fired Log Lighters for Wood Burning Fireplaces
603.1

DOTn

U.S.Department of Transportation
400 Seventh St. SW
Washington, DC 20590

49 CFR—Parts 100–180(2015): Hazardous Materials Regulations
703.2.2, 703.3.3, 703.3.4

49 CFR, Parts 192.281(e) & 192.283 (b)—(2009): Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
403.5.1

ICC

International Code Council, Inc.
500 New Jersey Ave, NW
Washington, DC 20001

IBC—21: International Building Code®
102.2.1, 201.3, 301.10, 301.11, 301.12, 301.14, 302.1, 302.2, 305.6, 306.5.1, 306.6, 401.1.1, 412.6, 413.3, 413.3.1, 501.1, 501.3, 501.12, 501.15.4, 501.15.4.1, 609.3, 614.10, 633.1, 634.1, 706.2

IECC—21: International Energy Conservation Code®
301.2

IFC—21: International Fire Code®
201.3, 401.2, 412.1, 412.6, 412.7, 412.8, 413.1, 413.3, 413.3.1, 413.6, 413.10.2.5, 633.1, 701.1, 701.2, 703.2, 703.2.2, 703.3.8, 703.4, 703.5, 704.1.2, 704.3, 704.4, 706.2, 706.3, 707.1, 707.2, 708.1

IMC—21: International Mechanical Code®
101.2.5, 201.3, 301.1.1, 301.13, 304.11, 307.1, 307.5, 501.1, 614.2, 614.10, 618.3, 621.1, 624.1, 631.2, 632.1

((~~IPC—21: International Plumbing Code®~~
~~201.3, 301.6, 307.3, 624.1.1, 624.2~~))

IRC—21: International Residential Code®
101.2, 703.2.1

MSS

Manufacturers Standardization Society of the Valve and Fittings Industry
127 Park Street, NE
Vienna, VA 22180

ANSI SP 58—2018: Pipe Hangers and Supports—Materials, Design and Manufacture
407.2

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

2—19: Hydrogen Technologies Code
703.1, 706.2

30A—21: Code for Motor Fuel Dispensing Facilities and Repair Garages
305.4, 305.10

CHAPTER 1
ADMINISTRATION

Note: Chapter 1 is entirely Seattle amendments to the *International Mechanical Code* and is not underlined.

SECTION 101
TITLE

101.1 Title. These regulations shall be known as the "Seattle Mechanical Code," may be cited as such, and are referred to herein as "this code." All references to the *International Mechanical Code* contained in this code mean the *Seattle Mechanical Code*.

SECTION 102
PURPOSE

102.1 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation, and maintenance or use of heating, ventilating, cooling, refrigeration systems, incinerators and other miscellaneous heat-producing appliances within the City. The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of *persons* who will or should be especially protected or benefited by the terms of this code.

SECTION 103
APPLICABILITY AND SCOPE

103.1 Scope. This code applies to the erection, installation, *alteration,* repair, relocation, replacement, addition to, use or maintenance of any heating, ventilating, cooling, refrigeration systems, incinerators or other miscellaneous heat-producing appliances within the City. The design and testing of *equipment* regulated by this code are subject to the approval of the code official. The installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be regulated by the International Fuel Gas Code. References in this code to Group R shall include Group I-1, Condition 2 assisted living facilities licensed by Washington state under chapter 388-78A WAC and Group I-1, Condition 2 residential treatment facilities licensed by Washington state under chapter 246-337 WAC.

Exceptions:

1. Detached one- and two-family dwellings and multiple single-family dwellings (*townhouse units*) not more than three stories above grade plane with a separate means of egress and their accessory structures shall comply with the *International Residential Code*.
2. The standards for liquefied petroleum gas installations are the 2017 edition of NFPA 58 (Liquefied Petroleum Gas Code) and the 2018 edition of ANSI Z223.1/NFPA 54 (National Fuel Gas Code), as amended.

103.2 Applicability of city laws. A mechanical permit application shall be considered under the Seattle Mechanical, Fuel Gas and Energy codes in effect on a date as provided below, or on a date as otherwise required by law.

1. Mechanical permit applications shall be considered under the codes in effect on the date used to determine the codes applicable to the building permit application according to Seattle Building Code Section 101.3 if any of Items 1.1 through 1.3 apply:
   1.1. The mechanical permit application is submitted as part of a building permit application;
   1.2. The mechanical permit application is for work directly associated with a building permit but is submitted separately from the building permit application; or
   1.3. The mechanical permit application is for initial tenant *alterations* submitted no later than 18 months after the date of the *approved* final inspection for the building, and is submitted before the expiration date of the building permit for the tenant *alteration,* as determined by *Seattle Building Code* Section 106.9.
2. Mechanical permit applications other than those subject to Item 1 shall be considered under the codes in effect on the date a complete mechanical permit application is submitted that complies with all the requirements of Section 116.

103.3 Additions, alterations and repairs. Additions, *alterations,* repairs and replacement of *equipment* or systems shall comply with the provisions for new *equipment* and systems except as otherwise provided in Section 104 of this code.

Exception: Additions, *alterations,* renovations or repairs to a mechanical system that is part of a building addition with less than 500 square feet of conditioned floor area are exempt from the requirements for *whole house ventilation systems,* Section 403.4.4.

103.4 Internal consistency. If in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. If there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

103.5 Referenced codes and standards. The codes and standards referenced in this code are part of the requirements of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the *equipment* or appliance, the conditions of the listing and manufacturer's instructions apply.

103.6 Appendices. Provisions in the *International Mechanical Code* appendices do not apply unless specifically adopted.

103.7 Metric units. Wherever in this code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

103.8 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, including local amendments. References to the "Building Code", "Fuel Gas Code", "Fire Code", "Residential Code" and "Plumbing Code" mean the Seattle editions of those codes.

SECTION 104
APPLICATION TO EXISTING MECHANICAL SYSTEMS

104.1 Additions, alterations, renovations or repairs. Additions, *alterations,* renovations or repairs may be made to any mechanical system without requiring the existing mechanical system to comply with all the requirements of this code, if the addition, *alteration,* renovation or repair conforms to the standards required for a new mechanical system. Additions, *alterations,* renovations or repairs shall not cause an existing system to become *unsafe,* unhealthy or overloaded.

Minor additions, *alterations,* renovations, and repairs to existing mechanical systems may be installed in accordance with the law in effect at the time the original installation was made, if *approved* by the code official.

104.2 Existing installations. Mechanical systems lawful at the time of the adoption of this code may continue their use, be maintained or repaired, be converted to another type of fuel, or have components replaced if the use, maintenance, repair, conversion of fuel, or component replacement is done in accordance with the basic original design and location, and no hazard to life, health or property has been or is created by such mechanical system.

104.3 Changes in building occupancy. Mechanical systems that are a part of a building or structure undergoing a change in *occupancy* as defined in the *International Building Code* shall comply with all requirements of this code that are applicable to the new use or *occupancy.*

104.4 Maintenance. All mechanical systems, materials, *equipment,* appurtenances and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices or safeguards that were required by a code in effect when the mechanical system was installed shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent is responsible for maintenance of mechanical systems and *equipment.* To determine compliance with this subsection, the code official may cause a mechanical system or *equipment* to be reinspected.

The fire chief and the code official each have authority to obtain compliance with the requirements of this subsection.

Exception: The code official may modify the requirements of this section where all or a portion of the building is unoccupied.

104.5 Moved buildings. Building or structures moved into or within the City shall comply with standards adopted by the code official. No building shall be moved into or within the City unless, prior to moving, the code official has inspected the building for compliance with this code and the permit holder has agreed to correct all deficiencies found and has been issued a building permit for the work. A bond or cash deposit in an amount sufficient to abate or demolish the building shall be posted prior to issuance of a permit. See Section 114 for information required on plans. Any moved building that is not in complete compliance with standards for moved buildings within eighteen months from the date of permit issuance and is found to be a public nuisance may be abated.

104.6 Landmarks—Historic buildings and structures. The code official may modify the specific requirements of this code as it applies to landmarks and require in lieu thereof alternate requirements that, in the opinion of the code official, will result in a reasonable degree of safety to the public and the occupants of those buildings.

For purposes of this section a landmark is a building or structure: that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or

characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

SECTION 105
ALTERNATE MATERIALS AND METHODS OF CONSTRUCTION

105.1 Alternate materials and methods of construction and design. This code does not prevent the use of any material, design or method of construction not specifically allowed or prohibited by this code, provided the alternate has been *approved* and its use authorized by the code official. The code official may approve an alternate, provided the code official finds that the proposed alternate complies with the provisions of this code and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation. The code official may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The code official may, but is not required to, record the approval of alternates and any relevant information in the files of the code official or on the *approved* construction documents.

SECTION 106
MODIFICATIONS

106.1 Modifications. The code official may modify the provisions of this code for individual cases if the code official finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety and sanitation when considered together with other safety features of the building or other relevant circumstances. The code official may, but is not required to, record the approval of modifications and any relevant information in the files of the code official or on the *approved* construction documents.

SECTION 107
TESTS

107.1 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code or evidence that any material or method of construction does not conform to the requirements of this code, the code official may require tests as proof of compliance, to be made at no expense to the City. Test methods shall be as specified in this code or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the code official shall determine the test procedures. All tests shall be made by an *approved* agency. Reports of such tests shall be retained by the code official for the period required for retention of public records.

SECTION 108
ORGANIZATION AND DUTIES OF CODE OFFICIAL

108.1 Jurisdiction of the Department of Construction and Inspections. The Department of Construction and Inspections is authorized to administer and enforce this code. The Department of Construction and Inspections is under the administrative and operational control of the Director, who is the code official.

108.2 Designees. The code official may appoint such officers, inspectors, assistants and employees as are authorized from time to time. The code official may authorize such employees and other agents as may be necessary to carry out the functions of the code official.

108.3 Right of entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the code official may enter a building or premises at any reasonable time to perform the duties imposed by this code.

108.4 Liability. Nothing in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City, or its officers, employees or agents, for any injury or damage resulting from the failure of *equipment* to conform to the provisions of this code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or approval authorized or issued or done in connection with the implementation or enforcement of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

This code shall not be construed to lessen or relieve the responsibility of any *person* owning, operating or controlling any *equipment,* building or structure for any damages to *persons* or property caused by defects, nor shall the Seattle Department of

Construction and Inspections or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

108.5 Responsibility for compliance. Compliance with the requirements of this code is the obligation of the owner of the building, structure or premises, the authorized agent of the owner, and other *persons* responsible for the condition or work, and not of the City or any of its officers, employees or agents.

SECTION 109
UNSAFE EQUIPMENT AND HAZARD CORRECTION ORDER

109.1 Emergency order. Whenever the code official finds that any *equipment* regulated by this code is in such a dangerous and *unsafe* condition as to constitute an imminent hazard to life or limb, the code official may issue an emergency order. The emergency order may (1) direct that the *equipment* be restored to a safe condition by a date certain; (2) require that the building, structure or premises, or portion thereof, containing the *equipment* be vacated within a reasonable time to be specified in the order, or in the case of extreme danger, the order may specify immediate vacation of the building, structure or premises, or portion thereof; or (3) authorize immediate disconnection of the utilities or energy source.

109.1.1 Service of emergency order. The order shall be posted on the premises or personally served on the owner of the building or premises or any *person* responsible for the condition. The order shall specify the time for compliance.

109.1.2 Effect of emergency order. No *person* may occupy a building, structure or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure or premises, or portion thereof, is restored to a safe condition as required by the order and this code. It is a violation for any *person* to fail to comply with an emergency order issued by the code official.

109.2 Hazard correction order. Whenever the code official finds that *unsafe equipment* exists, the code official may issue a hazard correction order specifying the conditions causing the *equipment* to be *unsafe* and directing the owner or other *person* responsible for the *unsafe equipment* to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the code official analyzing said conditions and establishing that the *equipment* is, in fact, safe. The code official may require that the report or analysis be prepared by a licensed engineer.

109.2.1 Service of hazard correction order. The order shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first class mail.

109.2.2 Effect of hazard correction order. It is a violation for any *person* to fail to comply with a hazard correction order as specified in this subsection.

SECTION 110
ENFORCEMENT, VIOLATIONS AND PENALTIES

110.1 Violations. It is a violation of this code for any *person* to:

1. Install, erect, construct, enlarge, alter, repair, replace, remodel, move, improve, remove, convert or demolish, equip, occupy, use or maintain any mechanical system or *equipment*, or cause or permit the same to be done, in the City, contrary to or in violation of any of the provisions of this code.
2. Knowingly aid, abet, counsel, encourage, hire, induce or otherwise procure another to violate or fail to comply with this code.
3. Use any material or install any device, appliance or *equipment* that is subject to this code and has not been *approved* by the code official.
4. Violate or fail to comply with any order issued by the code official pursuant to the provisions of this code or with any requirements of this code.
5. Remove, mutilate, destroy or conceal any notice or order issued or posted by the code official pursuant to the provisions of this code, or any notice or order issued or posted by the code official in response to a natural disaster or other emergency.
6. Conduct work under a permit without requesting an inspection as required by Section 116.

110.2 Notice of violation. If, after investigation, the code official determines that standards or requirements of this code have been violated or that orders or requirements have not been complied with, the code official may issue a notice of violation upon the owner, agent, or other *person* responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance.

110.2.1 Service of notice of violation. The notice shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person*, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail. Nothing in this section limits or precludes any action or proceeding to enforce this code, and nothing obligates or requires the code official to issue a notice of violation prior to the imposition of civil or criminal penalties.

110.2.2 Review of notice of violation by the code official. Any *person* affected by a notice of violation issued pursuant to Section 110.2 may obtain a review of the notice by making a request in writing to the code official within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or city holiday, the period runs until 5 p.m. of the next business day.

110.2.2.1 Review procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the code official unless otherwise agreed to by the *person* requesting the review. Any *person* affected by the notice of violation may submit additional information to the code official. The review shall be made by a representative of the code official who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and a site visit.

110.2.2.2 Decision. After the review, the code official shall:

1. Sustain the notice;
2. Withdraw the notice;
3. Amend the notice; or
4. Continue the review to a date certain.

110.2.2.3 Order. The code official shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the *persons* requesting the review and the *persons* named on the notice of violation, addressed to their last known address.

110.3 Stop work orders. The code official may issue a stop work order whenever any work is being done contrary to the provisions of this code, or contrary to a permit issued by the code official, or in the event of dangerous or *unsafe* conditions related to *equipment* or construction. The stop work order shall identify the violation and may prohibit work or other activity on the site.

110.3.1 Service of stop work order. The code official shall serve the stop work order by posting it in a conspicuous place at the site. If posting is not physically possible, the stop work order may be served by personal service or by regular first class mail to the last known address of: the property owner, the *person* doing or causing the work to be done, or the holder of a permit if work is being stopped on a permit. For purposes of this section, service is complete at the time of posting or of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or city holiday, the period runs until 5 p.m. on the next business day.

110.3.2 Effective date of stop work order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the *persons* identified in Section 110.3.1 is served.

110.3.3 Review of stop work orders by the code official. Any *person* aggrieved by a stop work order may obtain a review of the order by delivering to the code official a request in writing within two business days of the date of service of the stop work order.

110.3.3.1 Review procedure. The review shall occur within two business days after receipt by the code official of the request for review unless otherwise agreed by the *person* making the request. Any *person* affected by the stop work order may submit additional information to the code official for consideration as part of the review at any time prior to the review. The review will be made by a representative of the code official who will review all additional information received and may also request a site visit.

110.3.3.2 Decision. After the review, the code official may:

1. Sustain the stop work order;
2. Withdraw the stop work order;
3. Modify the stop work order; or
4. Continue the review to a date certain.

110.3.3.3 Order. The code official shall issue an order containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first class mail to the *person* or *persons* requesting the review, any *person* on whom the stop work order was served, and any other *person* who requested a copy before issuance of the order, addressed to their last known address.

110.4 Authority to disconnect utilities in emergencies. The code official has the authority to disconnect fuel-gas utility service or energy supplies to a building, structure, premises or *equipment* regulated by this code in case of emergency where nec-

essary to eliminate an immediate hazard to life or property. The code official may enter any building or premises to disconnect utility service. The code official shall, whenever possible, notify the serving utility, the owner and the occupant of the building, structure or premises of the decision to disconnect prior to taking such action, and shall notify the serving utility, owner and occupant of the building, structure or premises in writing of such disconnection immediately thereafter.

110.5 Authority to condemn equipment. Whenever the code official determines that any *equipment* or portion thereof regulated by this code is hazardous to life, health or property, the code official shall order in writing that such *equipment* either be disconnected, removed or restored to a safe or sanitary condition, as appropriate. The written notice shall fix a date certain for compliance with such order. It is a violation for any *person* to use or maintain defective *equipment* after receiving such notice. When any *equipment* or installation is to be disconnected, the code official shall give written notice of such disconnection and causes therefore within 24 hours to the serving utility, the owner and the occupant of the building, structure or premises. When any *equipment* is maintained in violation of this code, and in violation of a notice issued pursuant to the provisions of this section, the code official shall institute any appropriate action to prevent, restrain, correct or abate the violation.

110.6 Connection after order to disconnect. No *person* shall make connections from any energy, fuel or power supply nor supply energy or fuel to any *equipment* regulated by this code that has been disconnected or ordered to be disconnected by the code official, or the use of which has been ordered to be discontinued by the code official until the code official authorizes the reconnection and use of such *equipment*.

110.7 Civil penalties. Any *person* violating or failing to comply with the provisions of this code is subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until the date compliance is achieved. In cases where the code official has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

110.8 Enforcement in Municipal Court. Civil actions to enforce this code shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of a notice of violation or of an order following a review by the code official is not itself evidence that a violation exists.

110.9 Judicial review. Because civil actions to enforce this code must be brought exclusively in Seattle Municipal Court pursuant to Section 111.8, orders of the code official, including notices of violation issued under this chapter, are not subject to judicial review pursuant to chapter 36.70C RCW.

110.10 Alternative criminal penalty. Anyone who violates or fails to comply with any notice of violation or order issued by the code official pursuant to this code or who removes, mutilates, destroys or conceals a notice issued or posted by the code official shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

110.11 Additional relief. The code official may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

110.12 Administrative review by the code official. Prior to issuance of the mechanical permit, applicants may request administrative review by the code official of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the code official.

110.13 Administrative review by the Construction Codes Advisory Board. After administrative review by the code official, and prior to issuance of the mechanical permit, applicants may request review of decisions or actions pertaining to the application and interpretation of this code by the Construction Codes Advisory Board according to International Building Code Section 103.11, except for stop work orders, notices of violations and revocations of permits. The review will be performed by three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when electing members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the code official.

110.14 Recording. The code official may record a copy of any order or notice with the Department of Records and Elections of King County.

110.15 Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by Title 22 and this code may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

SECTION 111
RULES OF THE CODE OFFICIAL

111.1 Authority. The code official has authority to issue interpretations of this code and to adopt and enforce rules and regulations supplemental to this code as may be deemed necessary to clarify the application of the provisions of this code. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this code.

111.2 Procedure for adoption of rules. The code official shall promulgate, adopt and issue rules according to the procedures specified in the Administrative Code, Chapter 3.02 of the Seattle Municipal Code.

SECTION 112
CONSTRUCTION CODES ADVISORY BOARD

112.1 Construction Codes Advisory Board committee. A committee of the Construction Codes Advisory Board may examine proposed administrative rules, and amendments relating to this code and related provisions of other codes and make recommendations to the code official and to the City Council for changes in this code. The committee will be called on as needed by the Construction Codes Advisory Board.

SECTION 113
PERMITS

113.1 Permits required. Except as otherwise specifically provided in this code, a permit shall be obtained from the code official prior to each installation, *alteration,* repair, replacement or remodel of any *equipment* or mechanical system regulated by this code. A separate mechanical permit is required for each separate building or structure.

113.2 Work exempt from permit.

113.2.1 Mechanical. A mechanical permit is not required for the work listed below.

1. Portable heating appliances, portable ventilating *equipment,* and portable cooling units, if the total capacity of these portable appliances does not exceed 40 percent of the cumulative heating, cooling or ventilating requirements of a building or *dwelling unit* and does not exceed 3 kW or 10,000 Btu input.
2. Any closed system of steam, hot or chilled water piping within heating or cooling *equipment* regulated by this code.
3. Minor work or the replacement of any component part of a mechanical system that does not alter its original approval and complies with other applicable requirements of this code.

113.2.2 Refrigeration. A mechanical permit is not required for the following refrigerant *equipment*:

1. Any self-contained refrigerating *equipment* for which an operating permit is not required.
2. Any self-contained refrigeration system that does not exceed three horsepower rating.

113.3 Compliance required. All work shall comply with this code, even where no permit is required.

113.4 Flood hazard areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard as defined in Chapter 25.06 of the *Seattle Municipal Code,* subject to additional standards and requirements set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance.

113.5 Emergency repairs. In the case of an emergency, the installation, *alteration* or repair of any refrigeration system or *equipment* may be made without a permit, provided that application for a permit is made within the later of 24 hours or one working day from the time when the emergency work was started.

SECTION 114
APPLICATION FOR PERMIT

114.1 Application. To obtain a permit, the applicant shall first file an application in a format determined by the code official. Every such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, property address or similar description that will readily identify and definitely locate the proposed building or work.
3. Provide the contractor's business name, address, phone number and current contractor registration number (required if contractor has been selected). To obtain a permit for work on a refrigeration system, the applicant shall also provide the number of the refrigeration contractor license issued by the City.
4. Be accompanied by construction documents, including plans, diagrams, computations and specifications, *equipment* schedules and other data as required in Sections 114.2 and 114.3.
5. State the valuation of the mechanical work to be done. The valuation of the mechanical work is the estimated current value of all labor and material, whether actually paid for or not, for which the permit is sought.
6. Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority.
7. Give such other data and information as may be required by the code official.

8. State the name of the owner and the name, address and phone number of a contact *person.*
9. Substantially conform with applicable law in effect on the date described in Section R101.3, as modified by any exception.

114.2 Construction documents. Construction documents shall be submitted in one or more sets with each application for a permit, or shall be submitted in electronic format determined by the code official. The code official may require plans, computations and specifications to be prepared and designed by an engineer or architect licensed by the state to practice as such. Projects having a total mechanical valuation of $50,000 or larger shall have a mechanical engineering stamp and signature on each sheet.

Exception: A mechanical engineer's stamp or submission of construction documents is not required if the code official finds that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

114.3 Information on construction documents.

114.3.1 Clarity of plans. Plans shall be drawn to a clearly indicated and commonly accepted scale in a format determined by the code official.

114.3.2 Fire-resistive notes. The code official may require that plans for buildings more than two stories in height of other than Group R-3 and Group U *occupancies* indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing and communication conduits, pipes and similar systems.

114.3.3 Information required on plans. The plans or specifications shall show the following:

1. Layout for each floor with dimensions of all working spaces and a legend of all symbols used.
2. Location, size and material of all piping.
3. Location, size and materials of all air ducts, air inlets and air outlets.
4. Location of all fans, warm-air furnaces, boilers, absorption units, refrigerant compressors and condensers and the weight of all pieces of such *equipment* weighing 200 pounds or more.
5. Rated capacity or horsepower and efficiency rating of all boilers, warm-air furnaces, heat exchangers, blower fans, refrigerant compressors and absorption units. See also the *International Energy Conservation Code*.
6. Location, size and material of all *combustion* products vents and *chimneys.*
7. Location and area of all ventilation and *combustion* air openings and ducts.
8. Location of all air dampers and fire shutters.
9. The first sheet of each set of plans and specifications shall show the address of the proposed work and the name and address of the owner or lessee of the premises.
10. Architectural drawings, typical envelope cross sections and other drawings or data may be required to support system sizing calculations or other thermal requirements of this code or the *International Energy Conservation Code*.

SECTION 115
APPLICATION REVIEW AND PERMIT ISSUANCE

115.1 Issuance. The application and construction documents shall be reviewed by the code official. The construction documents may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

115.1.1 Issuance of permit. The code official shall issue a permit to the applicant if the code official finds the following:

1. The work described in the construction documents substantially conforms to the requirements of this code and other pertinent laws and ordinances;
2. The fees specified in the Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees have been paid; and
3. The applicant has complied with all requirements to be performed prior to issuance of a permit for the work under other pertinent laws, ordinances or regulations or included in a master use permit, or otherwise imposed by the building official.

When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

115.1.2 Compliance with approved construction documents. When the code official issues a permit, the code official shall endorse the permit in writing or in electronic format and stamp the plans "APPROVED." Such *approved* plans and permit shall not be changed, modified or altered without authorization from the code official, and all work shall be done in

accordance with the *approved* construction documents and permit except as authorized by the code official during a field inspection to correct errors or omissions, or as authorized by Section 115.2.

115.2 Revisions to the permit. When changes to the *approved* work are made during construction, approval of the code official shall be obtained prior to execution. The building or mechanical inspector may approve minor changes for work not reducing the structural strength or fire and life safety of the structure. The building or mechanical inspector shall determine if it is necessary to revise the *approved* construction documents. If revised plans are required, changes shall be submitted to and *approved* by the code official, accompanied by fees specified in the Seattle Municipal Code, Title 22, Subtitle IX, Permit Fees prior to *occupancy.* All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits.

Minor changes shall not incur additional fees if these changes do not (1) add to the general scope of work; (2) change the basic design concept; (3) involve major relocation of *equipment,* ducts, or pipes; (4) substantially alter *approved equipment* size; or (5) require extensive re-review of the plans and specifications.

115.3 Cancellation of permit applications. Applications may be cancelled if no permit is issued by the earlier of the following: (1) 12 months following the date of application; or (2) 60 days after the date of written notice that the permit is ready to be issued. After cancellation, construction documents may be returned to the applicant or destroyed by the code official.

The code official shall notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted in order to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

115.4 Extensions prior to permit issuance. At the discretion of the code official, applications for projects that require more than 12 months to review and approve may be extended for a period that provides reasonable time to complete the review and approval, but in no case longer than 24 months from the date of the original application. No application may be extended more than once. After cancellation, the applicant shall submit a new application and pay a new fee to restart the permit process.

Notwithstanding other provisions of this code, applications may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes or other causes related to the application that are beyond the applicant's control, or while the applicant is making progress toward issuance of a master use permit.

115.5 Retention of plans. One set of *approved* plans, which may be on microfilm or in electronic format, shall be retained by the code official. One set of *approved* plans shall be returned to the applicant and shall be kept at the site of the building or work for use by the inspection personnel at all times when the work authorized is in progress.

115.6 Validity of permit. The issuance or granting of a permit or approval of construction documents shall:

1. Not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or other pertinent laws and ordinances.
2. Not prevent the code official from requiring the correction of errors in the construction documents, or from preventing building operations being carried on thereunder when in violation of this code or of other pertinent laws and ordinances of the City.
3. Not prevent the code official from requiring correction of conditions found to be in violation of this code or other pertinent laws and ordinances of the City, or
4. Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the code official or other administrative authority requiring the correction of any such conditions.

115.7 Expiration of permits. Authority to do the work authorized by a permit expires 18 months from the date of issuance. An *approved* renewal extends the life of a permit for an additional 18 months from the prior expiration date. An *approved* reestablishment extends the life of the permit for 18 months from the date the permit expired.

Exceptions:

1. Initial permits for major construction projects that require more than 18 months to complete may be issued for a period that provides reasonable time to complete the work, according to an *approved* construction schedule. The building official may authorize a permit expiration date not to exceed three years from the date of issuance.
2. The code official may issue permits that expire in less than 18 months if the code official determines a shorter period is appropriate to complete the work.

115.8 Renewal of permits. Permits may be renewed and renewed permits may be further renewed by the code official, if the following conditions are met:

1. Application for renewal is made within the 30 day period immediately preceding the date of expiration of the permit; and
2. If the project has had an associated discretionary Land Use review, and the land use approval has not expired; and

3. If an application for renewal is made more than 18 months after the date of mandatory compliance with a new or revised edition of this code, the permit shall not be renewed unless:
   3.1. The code official determines that the permit complies, or is modified to comply with the Seattle Mechanical, Fuel Gas and Energy codes in effect on the date of application for renewal; or
   3.2. The work authorized by the permit is substantially underway and progressing at a rate *approved* by the building official. "Substantially underway" means that normally required inspections have been *approved* for work such as foundations, framing, mechanical, insulation and finish work is being completed on a continuing basis; or
   3.3. Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes or other extraordinary circumstances related to the work authorized by the permit, beyond the permit holder's control, subject to approval by the code official.

[S] 115.9 Reestablishment of expired permits. A new permit is required to complete work if a permit has expired and was not renewed.

Exception: A permit that expired less than one year prior to the date of a request for reestablishment may be reestablished upon approval of the code official if it complies with Items 2 and 3 of Section 115.8. Once re-established the permit will not be considered to have expired. The new expiration date of a re-established permit shall be determined in accordance with Section 115.7.

115.10 Revocation of mechanical permits. Whenever the code official determines there are grounds for revoking a permit, the code official may issue a notice of revocation. The notice of revocation shall identify the reason for the proposed revocation, including, but not limited to, the violations, the conditions violated, and any alleged false or misleading information provided.

115.10.1 Standards for revocation. The code official may revoke a permit if:

1. The code or the permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation; or
2. The permit was obtained with false or misleading information.

115.10.2 Service of notice of revocation. The notice of revocation shall be served upon the owner, agent or other responsible *person* by personal service or regular first class mail addressed to the last known address of such *person* or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

115.10.3 Effective date of revocation. The code official shall identify in the notice of revocation a date certain on which the revocation will take effect. This date may be stayed pending complete review by the code official pursuant to Section 115.10.4.

115.10.4 Review by the code official for notice of revocation. Any *person* aggrieved by a notice of revocation may obtain a review by making a request in writing to the code official within three business days of the date of service of the notice of revocation. The review shall occur within five business days after receipt by the building official of the request for review. Any *person* affected by the notice of revocation may submit additional information to the building official for consideration as part of the review at any time prior to the review.

115.10.4.1 Review procedure. The review will be made by a representative of the code official who will review all additional information received and may also request a site visit. After the review, the code official may:

1. Sustain the notice of revocation and affirm or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Modify the notice of revocation and affirm or modify the date the revocation will take effect; or
4. Continue the review to a date certain.

115.10.4.2 Order of revocation of permit. The code official shall issue an order containing the decision within ten days after the review is completed and shall cause the same to be sent by regular first class mail to the *person* or *persons* requesting the review, any other *person* on whom the notice of revocation was served, and any other *person* who requested a copy before issuance of the order. The order of the building official is the final order of the City, and the City and all parties shall be bound by the order.

SECTION 116
INSPECTIONS

116.1 General. All construction or work for which a permit is required is subject to inspection by the code official, and certain types of construction shall have special inspections by registered special inspectors specified in Chapter 17 of the *International Building Code*. In addition to the inspections specified above, the code official may make or require any other inspec-

tions of any mechanical work to ascertain compliance with the provisions of this code and other laws and ordinances that are enforced by the code official.

116.2 Inspection requests. The owner of the property or the owner's authorized agent, or the *person* designated by the owner or agent to do the work authorized by a permit shall notify the code official that work requiring inspection as specified in this section and Section 120 is ready for inspection.

116.3 Access for inspection. The permit holder and the *person* requesting any inspections required by this code shall provide access to and means for proper inspection of such work, including safety *equipment* required by the Washington Industrial Safety and Health Agency. The work shall remain accessible and exposed for inspection purposes until *approved* by the code official. Neither the code official nor the City shall be liable for expense entailed in the required removal or replacement of any material to allow inspection.

116.4 Inspection record. Work requiring a mechanical permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position that allows the code official to conveniently make the required entries regarding inspection of the work. This record shall be maintained in such a position by the permit holder or the permit holder's agent until final approval has been granted by the code official.

116.5 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the code official.

116.5.1 Effect of approval. Approval as a result of an inspection is not approval of any violation of the provisions of this code or of other pertinent laws and ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

116.6 Final inspection. When the installation of a mechanical system is complete, an additional and final inspection shall be made.

116.7 Operation of mechanical equipment. The requirements of this section do not prohibit the operation of any mechanical systems installed to replace existing *equipment* or fixtures serving an occupied portion of the building in the event a request for inspection of such *equipment* or fixture has been filed with the code official not more than 48 hours after such replacement work is completed, and before any portion of such mechanical system is concealed by any permanent portion of the building.

116.8 Testing of equipment and systems. Refrigeration *equipment* regulated by this code shall be tested and *approved* as required by Chapter 11 of this code. Fuel-oil piping shall be tested and *approved* as required by Chapter 13 of this code.

116.9 Special investigation. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the code official's permission to proceed, the code official may make a special investigation inspection before a permit is issued for the work. If a special investigation is made, a special investigation fee may be assessed in accordance with the Fee Subtitle.

116.10 Reinspections. The code official may require a reinspection if work for which inspection is called is not complete, required corrections are not made, the inspection record is not properly posted on the work site, the *approved* plans are not readily available to the inspector, access is not provided on the date for which inspection is requested, if deviations from construction documents that require the approval of the code official have been made without proper approval, or as otherwise required by the code official.

116.10.1 Compliance with Section 104.4. For the purpose of determining compliance with Section 104.4, Maintenance, the code official or the fire chief may cause any structure or system to be reinspected.

116.10.2 Reinspection fee. The code official may assess a reinspection fee as set forth in the *Seattle Municipal Code,* Title 22, Subtitle IX, Permit Fees for any action for which reinspection is required. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

SECTION 117
CONNECTION APPROVAL

117.1 Energy connections. No *person* shall make connections from a source of energy fuel to a mechanical system or *equipment* regulated by this code for which a permit is required until *approved* by the code official.

117.2 Temporary connections. The code official may authorize temporary connection of the mechanical *equipment* to the source of energy fuel for the purpose of testing the *equipment,* or for use under a temporary certificate of *occupancy.*

SECTION 118
REFRIGERATION LICENSES

118.1 Refrigeration licenses. No *person* shall perform any of the services or activities related to refrigeration systems regulated by Chapter 11 without a license required by Chapter 6.410 of the *Seattle Municipal Code,* or under the direct supervision of a *person* holding a required license.

SECTION 119
OPERATING PERMITS FOR REFRIGERATION SYSTEMS

119.1 An operating permit issued by the code official is required to operate any refrigeration system meeting any one of the following criteria:

1. Any system over 50 horsepower, or
2. Any system over 50 tons of refrigerant effect, or
3. Any system that contains over 150 pounds of refrigerant, or
4. Any system that includes a refrigerant containing a pressure vessel over six inches in diameter with a capacity of more than 5 cubic feet and a design working pressure under 250 psig, or
5. Any system that includes a refrigerant containing a pressure vessel over six inches in diameter having a capacity of one and one-half cubic feet and a design working pressure over 250 psig.

119.2 The operating permit will not be issued until the system has been inspected and *approved* by the code official as safe to operate and in compliance with the provisions of this code. The permit is valid for a period of one year, renewable annually. The permit shall be displayed in a conspicuous place adjacent to the refrigeration system.

SECTION 120
FEES

120.1 Fees. A fee for each mechanical permit and for other activities related to the enforcement of this code shall be paid as set forth in the *Seattle Municipal Code,* Title 22, Subtitle IX, Permit Fees.

CHAPTER 2
DEFINITIONS

User note:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purposes of the code.*

SECTION 201
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

[S] 201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *International Building Code*, *International Fire Code*, *Seattle Electrical Code*, *International Fuel Gas Code* or ((~~*International*~~)) *Uniform Plumbing Code*, such terms shall have meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202
GENERAL DEFINITIONS

ABRASIVE MATERIALS. Moderately abrasive particulate in high concentrations, and highly abrasive particulate in moderate and high concentrations, such as alumina, bauxite, iron silicate, sand and slag.

ABSORPTION SYSTEM. A refrigerating system in which refrigerant is pressurized by pumping a chemical solution of refrigerant in absorbent, and then separated by the addition of heat in a generator, condensed (to reject heat), expanded, evaporated (to provide refrigeration), and reabsorbed in an absorber to repeat the cycle; the system can be single or multiple effect, the latter using multiple stages or internally cascaded use of heat to improve efficiency.

ACCESS (TO). That which enables a device, *appliance* or *equipment* to be reached by ready access or by a means that first requires the removal or movement of a panel or similar obstruction [see also *Ready access (to)*].

AIR. Air supplied to mechanical *equipment* and *appliances* for *combustion*, ventilation, cooling and similar purposes. Standard air is air at standard temperature and pressure, namely, 70ºF (21ºC) and 29.92 inches of mercury (101.3 kPa).

AIR, EXHAUST. Air being removed from any space, *appliance* or piece of *equipment* and conveyed directly to the atmosphere by means of openings or ducts.

AIR, MAKEUP. Any combination of outdoor and transfer air intended to replace *exhaust air* and exfiltration.

AIR, OUTDOOR. Ambient air that enters a building through a ventilation system, through intentional openings for natural ventilation, or by infiltration.

AIR, TRANSFER. Air moved from one indoor space to another.

AIR CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a conditioned space.

AIR DISPERSION SYSTEM. Any diffuser system designed to both convey air within a room, space or area and diffuse air into that space while operating under positive pressure. Systems are commonly constructed of, but not limited to, fabric or plastic film.

AIR DISTRIBUTION SYSTEM. Any system of ducts, *plenums* and air-handling *equipment* that circulates air within a space or spaces and includes systems made up of one or more air-handling units.

AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return ducts, and shall include any apparatus installed in connection therewith.

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

[A] ALTERATION. A change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

APPLIANCE, EXISTING. Any *appliance* regulated by this code that was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

APPLIANCE, VENTED. An *appliance* designed and installed in such a manner that all of the products of *combustion* are conveyed directly from the *appliance* to the outdoor atmosphere through an *approved chimney* or vent system.

APPLIANCE TYPE.

High-heat appliance. Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature greater than 2,000ºF (1093ºC).

Low-heat appliance (residential appliance). Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature of 1,000ºF (538ºC) or less.

Medium-heat appliance. Any *appliance* in which the products of *combustion* at the point of entrance to the flue under normal operating conditions have a temperature of more than 1,000ºF (538ºC), but not greater than 2,000ºF (1093ºC).

[A] APPROVED. Acceptable to the code official.

[A] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been approved by the code official.

[S] ((~~AUTOMATIC BOILER.~~ ~~Any class of boiler that is equipped with the controls and limit devices specified in Chapter 10.~~))

[W] BALANCED WHOLE HOUSE VENTILATION. Any combination of concurrently operating dwelling or sleeping unit mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10 percent or 5 cfm, whichever is greater, of the total mechanical supply airflow rate.

BATHROOM. A room containing a bathtub, shower, spa or similar bathing fixture.

[S] BOILER. A closed ((~~heating *appliance* intended to supply hot water or steam for space heating, processing or power purposes~~)) vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the direct application of heat. ((~~Low-pressure boilers operate at pressures less than or equal to 15 pounds per square inch (psi) (103 kPa) for steam and 160 psi (1103 kPa) for water. High-pressure boilers operate at pressures exceeding those pressures.~~)) The term "boiler" shall also include fired units for heating or vaporizing liquids other than water where these systems are complete within themselves.

[S] BOILER CODE. The *Seattle Boiler* and *Pressure Vessel Code*.

BOILER ROOM. A room primarily utilized for the installation of a boiler.

BRAZED JOINT. A gastight joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature above 1,000ºF (538ºC), but lower than the melting temperature of the parts to be joined.

BRAZING. A metal joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 1,000ºF (538ºC), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary attraction.

BREATHING ZONE. The region within an occupied space between planes 3 and 72 inches (76 and 1829 mm) above the floor and more than 2 feet (610 mm) from the walls of the space or from fixed air-conditioning *equipment*.

BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (454 g) of water 1ºF (0.56ºC) (1 Btu = 1055 J).

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any *occupancy*.

[BF] CEILING RADIATION DAMPER. A *listed* device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening. Ceiling radiation dampers are classified for use in either static systems that will automatically shut down in the event of a fire or in dynamic systems that continue to operate during a fire. A dynamic ceiling radiation damper is tested and rated for closure under elevated temperature airflow.

CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of *combustion* and air from a fuel-burning *appliance* to the outdoor atmosphere.

Factory-built chimney. A *listed* and *labeled chimney* composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed *chimney* composed of solid masonry units, bricks, stones or concrete.

Metal chimney. A field-constructed *chimney* of metal.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning *appliance* to a *chimney*.

CLEARANCE. The minimum distance through air measured between the heat-producing surface of the mechanical *appliance*, device or *equipment* and the surface of the combustible material or assembly.

CLOSED COMBUSTION SOLID-FUEL-BURNING APPLIANCE. A heat-producing *appliance* that employs a *combustion* chamber that does not have openings other than the flue collar, fuel charging door and adjustable openings provided to control the amount of *combustion air* that enters the *combustion* chamber.

CLOTHES DRYER. An *appliance* used to dry wet laundry by means of heat.

[S][A] CODE. These regulations, subsequent amendments thereto, or any emergency rule or regulation that ((~~the administrative authority having jurisdiction~~)) has been lawfully adopted.

[S][A] CODE OFFICIAL. The ((~~officer or other designated authority charged with the administration and enforcement of this code~~)) Director of the Department of Construction and Inspections, or a duly authorized representative.

[BF] COMBINATION FIRE/SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, be controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

[F] COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100ºF (38ºC). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100ºF (38ºC) and below 140ºF (60ºC).

Class IIIA. Liquids having a closed cup flash point at or above 140ºF (60ºC) and below 200ºF (93ºC).

Class IIIB. Liquids having a closed cup flash point at or above 200ºF (93ºC).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION. In the context of this code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

COMBUSTION AIR. Air necessary for complete *combustion* of a fuel, including *theoretical air* and excess air.

COMBUSTION CHAMBER. The portion of an *appliance* within which *combustion* occurs.

COMBUSTION PRODUCTS. Constituents resulting from the *combustion* of a fuel with the oxygen of the air, including the inert gases, but excluding excess air.

COMMERCIAL COOKING APPLIANCES. *Appliances* used in a commercial food service establishment for heating or cooking food. For the purpose of this definition, a commercial food service establishment is where food is prepared for sale or is prepared on a scale that is by volume and frequency not representative of domestic household cooking.

COMMERCIAL COOKING RECIRCULATING SYSTEM. Self-contained system consisting of the exhaust hood, the cooking *equipment*, the filters and the fire suppression system. The system is designed to capture cooking vapors and residues generated from commercial cooking *equipment*. The system removes contaminants from the *exhaust air* and recirculates the air to the space from which it was withdrawn.

COMMERCIAL KITCHEN HOODS.

Backshelf hood. A backshelf hood is also referred to as a low-proximity hood, or as a sidewall hood where wall mounted. Its front lower lip is low over the *appliance*(s) and is "set back" from the front of the *appliance*(s). It is always closed to the rear of the *appliances* by a panel where free-standing, or by a panel or wall where wall mounted, and its height above the cooking surface varies. (This style of hood can be constructed with partial end panels to increase its effectiveness in capturing the effluent generated by the cooking operation.)

Double island canopy hood. A double island canopy hood is placed over back-to-back *appliances* or *appliance* lines. It is open on all sides and overhangs both fronts and the sides of the *appliance*(s). It could have a wall panel between the backs of the *appliances*. (The fact that *exhaust air* is drawn from both sides of the double canopy to meet in the center causes each side of this hood to emulate a wall canopy hood, and thus it functions much the same with or without an actual wall panel between the backs of the *appliances*.)

Eyebrow hood. An eyebrow hood is mounted directly to the face of an *appliance*, such as an oven and dishwasher, above the opening(s) or door(s) from which effluent is emitted, extending past the sides and overhanging the front of the opening to capture the effluent.

Pass-over hood. A pass-over hood is a free-standing form of a backshelf hood constructed low enough to pass food over the top.

Single island canopy hood. A single island canopy hood is placed over a single *appliance* or *appliance* line. It is open on all sides and overhangs the front, rear and sides of the *appliance*(s). A single island canopy is more susceptible to cross drafts and requires a greater exhaust airflow than an equivalent sized wall-mounted canopy to capture and contain effluent generated by the cooking operation(s).

Wall canopy hood. A wall canopy exhaust hood is mounted against a wall above a single *appliance* or line of *appliance*(s), or it could be free-standing with a back panel from the rear of the *appliances* to the hood. It overhangs the front and sides of the *appliance*(s) on all open sides.

The wall acts as a back panel, forcing the *makeup air* to be drawn across the front of the cooking *equipment*, thus increasing the effectiveness of the hood to capture and contain effluent generated by the cooking operation(s).

COMPENSATING HOODS. *Compensating hoods* are those having integral (built-in) *makeup air* supply. The *makeup air* supply for such hoods is generally supplied from: short-circuit flow from inside the hood, air curtain flow from the bottom of the front face, and front face discharge from the outside front wall of the hood. The compensating makeup airflow can also be supplied from the rear or side of the hood, or the rear, front or sides of the cooking *equipment*. The makeup airflow can be one or a combination of methods.

COMPRESSOR. A specific machine, with or without accessories, for compressing a gas.

COMPRESSOR, POSITIVE DISPLACEMENT. A compressor in which increase in pressure is attained by changing the internal volume of the compression chamber.

COMPRESSOR UNIT. A compressor with its prime mover and accessories.

CONCEALED LOCATION. A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

CONDENSATE. The liquid that condenses from a gas (including flue gas) caused by a reduction in temperature.

CONDENSER. A heat exchanger designed to liquefy refrigerant vapor by removal of heat.

CONDENSING UNIT. A specific refrigerating machine combination for a given refrigerant, consisting of one or more power-driven compressors, condensers and, where required, liquid receivers, and the regularly furnished accessories.

[S] CONDITIONED SPACE. An area ((~~,~~)) or room ((~~or space that is enclosed~~)) within ((~~the~~)) a building ((~~thermal envelope and that is directly heated or cooled or that is indirectly~~)) being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent conditioned space. ((~~Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.~~)) Elevator shafts, stair enclosures, enclosed corridors connecting conditioned spaces, and enclosed spaces, through which conditioned air is transferred at a rate exceeding three air changes per hour are considered conditioned spaces for the purpose of the building thermal envelope requirements.

[S] CONFINED SPACE. A space having a volume less than 50 cubic feet per 1,000 Btu per hour (Btu/h) (4.8 m^3/kW) of the aggregate input rating of all appliances installed in that space.

[A] CONSTRUCTION DOCUMENTS. The written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

[S] CONTAINER (REFRIGERANT). A cylinder for the transportation of refrigerant.

CONTROL. A manual or automatic device designed to regulate the gas, air, water or electrical supply to, or operation of, a mechanical system.

CONVERSION BURNER. A burner designed to supply gaseous fuel to an *appliance* originally designed to utilize another fuel.

COOKING APPLIANCE. See *Commercial cooking appliances*.

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or *combustion* gases.

Volume damper. A device that, where installed, will restrict, retard or direct the flow of air in a duct, or the products of *combustion* in a heat-producing *appliance*, its vent connector, vent or *chimney* therefrom.

[BS] DESIGN FLOOD ELEVATION. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard area map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the building's perimeter plus the depth number, in feet (mm), specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

DESIGN WORKING PRESSURE. The maximum allowable working pressure for which a specific part of a system is designed.

DIRECT EVAPORATIVE COOLING. The evaporative cooling process where water evaporates directly into the air stream, reducing the air's dry-bulb temperature and raising its humidity level.

[S] DIRECT REFRIGERATION SYSTEM. A system in which the evaporator or condenser of the refrigerating system is in direct contact with the air or other substances to be cooled or heated. See Figure 2-1 for a diagram of a type of direct refrigeration system.

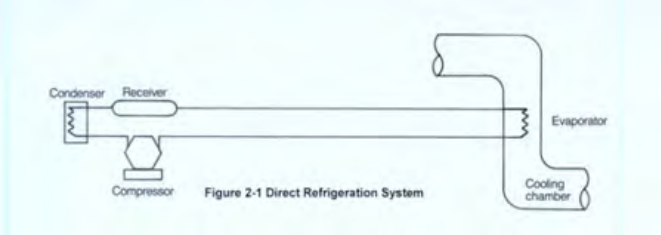


Figure 2-1 Direct Refrigeration System

DIRECT SOLAR SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop is not separated from the load.

[FG] DIRECT-VENT APPLIANCES. *Appliances* that are constructed and installed so that all air for *combustion* is derived from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

DISCRETE PRODUCT. Products that are noncontinuous, individual, distinct pieces such as, but not limited to, electrical, plumbing and mechanical products and duct straps, duct fittings, duct registers and pipe hangers.

[W] DISTRIBUTED WHOLE HOUSE VENTILATION. A whole house ventilation system shall be considered distributed when it supplies outdoor air directly (not transfer air) to each dwelling or sleeping unit habitable space (living room, den, office, *interior adjacent room*, interior adjoining spaces or bedroom), and exhausts air from all kitchens and bathrooms directly outside.

DRAFT. The pressure difference existing between the *appliance* or any component part and the atmosphere, that causes a continuous flow of air and products of *combustion* through the gas passages of the *appliance* to the atmosphere.

Induced draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the *appliance* and the *chimney* or vent termination.

Natural draft. The pressure difference created by a vent or *chimney* because of its height, and the temperature difference between the flue gases and the atmosphere.

DRAIN-BACK SYSTEM. A solar thermal system in which the fluid in the solar collector loop is gravity drained from the collector into a holding tank under prescribed circumstances.

DRIP. The container placed at a low point in a system of piping to collect condensate and from which the condensate is removable.

DRY CLEANING SYSTEMS. Dry cleaning plants or systems are classified as follows:

Type I. Those systems using Class I flammable liquid solvents having a flash point below 100ºF (38ºC).

Type II. Those systems using Class II combustible liquid solvents having a flash point at or above 100ºF (38ºC) and below 140ºF (60ºC).

Type III. Those systems using Class III combustible liquid solvents having a flash point at or above 140ºF (60ºC).

Types IV and V. Those systems using Class IV nonflammable liquid solvents.

DUCT. A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

DUCT FURNACE. A warm-air furnace normally installed in an air distribution duct to supply warm air for heating. This definition shall apply only to a warm-air heating *appliance* that, for air circulation, depends on a blower not furnished as part of the furnace.

DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, *plenums*, fans and accessory air-handling *equipment* and *appliances*.

DUCTLESS MINI-SPLIT SYSTEM. A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a traditional ductwork system.

[BG] DWELLING. A building or portion thereof that contains not more than two *dwelling* units.

[A] DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

ELECTRIC HEATING APPLIANCE. An *appliance* that produces heat energy to create a warm environment by the application of electric power to resistance elements, refrigerant compressors or dissimilar material junctions.

[W] ENCLOSED KITCHEN. A kitchen whose permanent openings to *interior adjacent spaces* do not exceed a total of 60 square feet (6 m^2).

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from or reject energy to *exhaust air* for the purpose of preheating, precooling, humidifying or dehumidifying outdoor *ventilation air* prior to supplying such air to a space, either directly or as part of an HVAC system.

[S] ENVIRONMENTAL AIR. Air that is, at temperatures not exceeding 250ºF (121ºC), conveyed to or from occupied areas through ducts that are not part of the heating or air-conditioning system, such as ventilation for human usage, relief air other than relief air from individual dwelling units or sleeping units, domestic kitchen range exhaust, bathroom exhaust, domestic clothes dryer exhaust, transformer vault exhaust, elevator exhaust, and parking garage exhaust.

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than *appliances* that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

EQUIPMENT, EXISTING. Any *equipment* regulated by this code which was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

EVAPORATIVE COOLER. A device used for reducing the sensible heat of air for cooling by the process of evaporation of water into an airstream.

EVAPORATIVE COOLING SYSTEM. The *equipment* and *appliances* intended or installed for the purpose of environmental cooling by an evaporative cooler from which the conditioned air is distributed through ducts or *plenums* to the conditioned area.

EVAPORATOR. That part of the system in which liquid refrigerant is vaporized to produce refrigeration.

EXCESS AIR. The amount of air provided in addition to *theoretical air* to achieve complete *combustion* of a fuel, thereby preventing the formation of dangerous products of *combustion*.

EXFILTRATION. Uncontrolled outward air leakage from conditioned spaces through unintentional openings in ceilings, floors and walls to unconditioned spaces or the outdoors caused by pressure differences across these openings resulting from wind, the stack effect created by temperature differences between indoors and outdoors, and imbalances between supply and exhaust airflow rates.

EXHAUST SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers, grilles and hoods through which air is conducted from the space or spaces and exhausted to the outdoor atmosphere.

[S] EXIT PASSAGEWAY. An exit component that provides a protected path of egress travel in a horizontal direction to an exit or to the exit discharge.

Note: The exit passageway definition is a portion of the same definition found in the 2021 Seattle Building Code.

[BE] EXIT PASSAGEWAY. An *exit* component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an *exit* or to the *exit discharge*.

EXTRA-HEAVY-DUTY COOKING APPLIANCE. Extra-heavy-duty cooking *appliances* are those utilizing open flame combustion of solid fuel at any time.

[S] FIRE AREA. The aggregate floor area enclosed and bounded by *fire walls*, *fire barriers*, *exterior walls* or *horizontal assemblies* of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

FURNACE. A completely self-contained heating unit that is designed to supply heated air to spaces remote from or adjacent to the *appliance* location.

FURNACE ROOM. A room primarily utilized for the installation of fuel-burning, space-heating and water-heating *appliances* other than boilers (see also *Boiler room*).

FUSIBLE PLUG. A device arranged to relieve pressure by operation of a fusible member at a predetermined temperature.

[S][F] GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated *equipment* and supplies are stored or used.

GROUND SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances. The location is not necessarily categorized in the *International Building Code* as a high-hazard use group classification.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

HEAT PUMP. A refrigeration system that extracts heat from one substance and transfers it to another portion of the same substance or to a second substance at a higher temperature for a beneficial purpose.

HEAT TRANSFER LIQUID. The operating or thermal storage liquid in a mechanical system, including water or other liquid base, and additives at the concentration present under operating conditions used to move heat from one location to another. Refrigerants are not included as heat transfer liquids.

HEAVY-DUTY COOKING APPLIANCE. Heavy-duty cooking *appliances* include electric under-fired broilers, electric chain (conveyor) broilers, gas under-fired broilers, gas chain (conveyor) broilers, gas open-burner ranges (with or without oven), electric and gas wok ranges, smokers, smoker ovens, and electric and gas over-fired (upright) broilers and salamanders.

HIGH-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the location of components is such that a leakage of refrigerant from a failed connection, seal or component will enter an *occupancy* classified area, other than the *machinery room*.

[S][BG] HIGH-RISE BUILDING. A building with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. For the purposes of this definition, an occupied roof with an occupant load of 50 or more in a building that is equipped with an automatic sprinkler system and an occupant load of 10 or more in a building not equipped with an automatic fire sprinkler system are considered to be occupied floors.

HIGH-SIDE PRESSURE. The parts of a refrigerating system subject to condenser pressure.

[S] HOOD. An air intake device used to capture by entrapment, impingement, adhesion or similar means, grease, moisture, heat and similar contaminants before they enter a duct system.

Type I. A kitchen hood for collecting and removing grease vapors and smoke generated from medium-duty, heavy-duty, extra-heavy-duty, and some *light-duty cooking appliances*. Such hoods are equipped with a fire suppression system.

Type II. A general kitchen hood for collecting and removing steam, vapor, heat, odors and products of *combustion* generated from some *light-duty cooking appliances*.

[FG] HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating *appliances* utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include *appliance* burners, burner ignitors and electrical switching devices.

[F] IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH). The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It is generally expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m^3).

INDIRECT EVAPORATIVE COOLING. The evaporative cooling process where water evaporates into a secondary air stream, removing heat from a primary air stream utilizing a heat exchanger.

[S] INDIRECT REFRIGERATION SYSTEM. A system in which a secondary coolant cooled or heated by the refrigerating system is circulated to the air or other substance to be cooled or heated. See Figure 2-2. Indirect systems are distinguished by the following methods of application:

Closed system. A system in which a secondary fluid is either cooled or heated by the refrigerating system and then circulated within a closed circuit in indirect contact with the air or other substance to be cooled or heated.

Double-indirect open-spray system. A system in which the secondary substance for an indirect open-spray system is heated or cooled by an intermediate coolant circulated from a second enclosure.

Open-spray system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then circulated in direct contact with the air or other substance to be cooled or heated.

Vented closed system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then passed through a closed circuit in the air or other substance to be cooled or heated, except that the evaporator or condenser is placed in an open or appropriately vented tank.

[S]

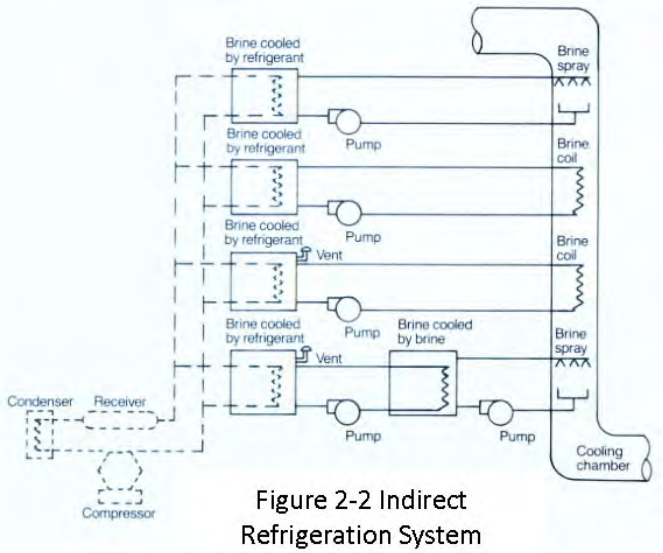


Figure 2-2 Indirect Refrigeration System

INDIRECT SOLAR SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop circulates between the solar collector and a heat exchanger and such gas or liquid is not drained from the system or supplied to the load during normal operation.

INFILTRATION. Uncontrolled inward air leakage to conditioned spaces through unintentional openings in ceilings, floors and walls from unconditioned spaces or the outdoors caused by pressure differences across these openings resulting from wind, the stack effect created by temperature differences between indoors and outdoors, and imbalances between supply and exhaust airflow rates.

[W] INTERIOR ADJACENT ROOM. An enclosed room without exterior windows or openings to the outdoors located within a dwelling or sleeping unit that does not have interior unobstructed openings required for an interior adjoining space.

[W] INTERIOR ADJOINING SPACE. A room or space without openings to the outdoors that is naturally ventilated from another habitable space by unobstructed fixed openings size in accordance with Section 402.3.

[S] INTERIOR EXIT STAIRWAY. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

Note: The interior exit stairway definition is identical to the same definition found in Chapter 2 of the 2021 *Seattle Building Code*.

INTERLOCK. A device actuated by another device with which it is directly associated, to govern succeeding operations of the same or allied devices. A circuit in which a given action cannot occur until after one or more other actions have taken place.

JOINT, FLANGED. A joint made by bolting together a pair of flanged ends.

JOINT, FLARED. A metal-to-metal compression joint in which a conical spread is made on the end of a tube that is compressed by a flare nut against a mating flare.

JOINT, PLASTIC ADHESIVE. A joint made in thermoset plastic piping by the use of an adhesive substance that forms a continuous bond between the mating surfaces without dissolving either one of them.

JOINT, PLASTIC HEAT FUSION. A joint made in thermoplastic piping by heating the parts sufficiently to permit fusion of the materials when the parts are pressed together.

JOINT, PLASTIC SOLVENT CEMENT. A joint made in thermoplastic piping by the use of a solvent or solvent cement that forms a continuous bond between the mating surfaces.

JOINT, SOLDERED. A gastight joint obtained by the joining of metal parts with metallic mixtures of alloys that melt at temperatures between 400ºF (204ºC) and 1,000ºF (538ºC).

JOINT, WELDED. A gastight joint obtained by the joining of metal parts in molten state.

[A] LABELED. *Equipment*, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the labeled items and whose labeling indicates either that the *equipment*, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LARGE-DIAMETER CEILING FAN. A ceiling fan that is greater than 7 feet (2134 mm) in diameter. These fans are also referred to as high-volume, low-speed (HVLS) fans.

[S] LIGHT-DUTY COOKING APPLIANCE. Light-duty cooking *appliances* include gas and electric ovens of a maximum 6 kW or 20,000 Btu/h capacity (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, countertop conveyorized baking/finishing, deck and pastry), electric and gas steam-jacketed kettles, electric and gas pasta cookers, electric and gas compartment steamers (both pressure and atmospheric) and electric and gas cheesemelters.

[FG] LIMIT CONTROL. A device responsive to changes in pressure, temperature or level for turning on, shutting off or throttling the gas supply to an *appliance*.

LIMITED CHARGE SYSTEM. A system in which, with the compressor idle, the design pressure will not be exceeded when the refrigerant charge has completely evaporated.

[A] LISTED. *Equipment,* materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment*, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

LIVING SPACE. Space within a *dwelling unit* utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

[W] LOCAL EXHAUST. An exhaust system that uses one or more fans to exhaust air from a specific room or rooms within a residential dwelling or *sleeping unit*.

LOWER EXPLOSIVE LIMIT (LEL). See *LFL*.

[F] LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as LEL or lower explosive limit.

LOWER FLAMMABLE LIMIT (REFRIGERANT) (LFL). The minimum concentration of refrigerant that is capable of propagating a flame through a homogeneous mixture of refrigerant and air.

LOW-PRESSURE HOT-WATER-HEATING BOILER. A boiler furnishing hot water at pressures not exceeding 160 psi (1103 kPa) and at temperatures not exceeding 250ºF (121ºC).

LOW-PRESSURE STEAM-HEATING BOILER. A boiler furnishing steam at pressures not exceeding 15 psi (103 kPa).

LOW-PROBABILITY PUMP. A pump that is designed to prevent atmospheric release of the pumped fluid by one of the following methods:

1. The pump is permanently sealed.
2. The pump incorporates a static seal.
3. The pump incorporates not less than two sequential dynamic shaft seals to isolate the pumped fluid from atmosphere at shaft penetrations and automatically shuts down upon failure of any seal.

LOW-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the location of components is such that a leakage of refrigerant from a failed connection, seal or component will not enter an occupancy-classified area, other than the *machinery room*.

LOW-SIDE PRESSURE. The parts of a refrigerating system subject to evaporator pressure.

MACHINERY ROOM. An enclosed space that is required by Chapter 11 to contain refrigeration *equipment* and to comply with Sections 1105 and 1106.

MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced-draft portion under nonpositive static pressure or a forced-draft portion under positive static pressure.

Forced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static pressure.

Induced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Power venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

MECHANICAL EQUIPMENT/APPLIANCE ROOM. A room or space in which nonfuel-fired mechanical *equipment* and *appliances* are located.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL JOINT.

1. A connection between pipes, fittings, or pipes and fittings that is not welded, brazed, caulked, soldered, solvent cemented or heat fused.
2. A general form of gas- or liquid-tight connections obtained by the joining of parts through a positive holding mechanical construction such as, but not limited to, flanged, screwed, clamped or flared connections.

MECHANICAL SYSTEM. A system specifically addressed and regulated in this code and composed of components, devices, *appliances* and *equipment*.

MEDIUM-DUTY COOKING APPLIANCE. Medium-duty cooking *appliances* include electric discrete element ranges (with or without oven), electric and gas hot-top ranges, electric and gas griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers and pressure fryers), electric and gas conveyor pizza ovens, electric and gas tilting skillets (braising pans) and electric and gas rotisseries.

MODULAR BOILER. A steam or hot-water-heating assembly consisting of a group of individual boilers called modules intended to be installed as a unit without intervening stop valves. Modules are under one jacket or are individually jacketed. The individual modules shall be limited to a maximum input rating of 400,000 Btu/h (117 228 W) gas, 3 gallons per hour (gph) (11.4 L/h) oil, or 115 kW (electric).

NATURAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

NATURAL VENTILATION. The movement of air into and out of a space through intentionally provided openings, such as windows and doors, or through nonpowered ventilators.

NET OCCUPIABLE FLOOR AREA. The floor area of an *occupiable space* defined by the inside surfaces of its walls but excluding shafts, column enclosures and other permanently enclosed, inaccessible and unoccupiable areas. Obstructions in the space such as furnishings, display or storage racks and other obstructions, whether temporary or permanent, shall not be deducted from the space area.

NO-FLOW CONDITION (SOLAR). A condition where thermal energy is not transferred from a solar thermal collector by means of flow of a heat transfer fluid.

NONABRASIVE/ABRASIVE MATERIALS. Nonabrasive particulate in high concentrations, moderately abrasive particulate in low and moderate concentrations, and highly abrasive particulate in low concentrations, such as alfalfa, asphalt, plaster, gypsum and salt.

NONCOMBUSTIBLE MATERIALS. Materials that, when tested in accordance with ASTM E136, have not fewer than three of four specimens tested meeting all of the following criteria:

1. The recorded temperature of the surface and interior thermocouples shall not at any time during the test rise more than 54ºF (30ºC) above the furnace temperature at the beginning of the test.
2. There shall not be flaming from the specimen after the first 30 seconds.
3. If the weight loss of the specimen during testing exceeds 50 percent, the recorded temperature of the surface and interior thermocouples shall not at any time during the test rise above the furnace air temperature at the beginning of the test, and there shall not be flaming of the specimen.

NONFOOD-GRADE FLUID. Any fluid that is not designated as a food-grade fluid.

[W] NOT BALANCED WHOLE HOUSE VENTILATION. A whole house ventilation system serving a dwelling or sleeping unit that is not considered balanced in accordance with the definition in this code for *balanced whole house ventilation* system. Only other than Group R-2 dwelling and sleeping units are allowed in accordance with Section 403.4.4.1 to have not *balanced whole house ventilation* systems.

[W] NOT DISTRIBUTED WHOLE HOUSE VENTILATION. A whole house ventilation system shall be considered not distributed when either the supply system or the exhaust system is not distributed. Supply systems are not distributed when a habitable space is supplied with outdoor air to ventilate an *interior adjacent room* or an interior adjoining space. Exhaust

systems are not distributed when all bathrooms and kitchens are not exhausted by the whole house ventilation system. If either the supply system or the exhaust system is not distributed, then the ventilation quality adjustment system coefficient adjustment is required in accordance with Section C403.4.3.

[A] OCCUPANCY. The purpose for which a building, or portion thereof, is utilized or occupied.

OCCUPATIONAL EXPOSURE LIMIT (OEL). The time-weighted average (TWA) concentration for a normal 8-hour workday and a 40-hour workweek to which nearly all workers can be repeatedly exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, TERA OARS WEEL, or consistent value.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and *equipment* rooms, that are only intended to be occupied occasionally and for short periods of time.

OFFSET (VENT). A combination of *approved* bends that make two changes in direction bringing one section of the vent out of line but into a line parallel with the other section.

OUTDOOR AIR. Air taken from the outdoors, and therefore not previously circulated through the system.

OUTDOOR OPENING. A door, window, louver or skylight openable to the outdoor atmosphere.

OUTLET. A threaded connection or bolted flange in a piping system to which a gas-burning *appliance* is attached.

PANEL HEATING. A method of radiant space heating in which heat is supplied by large heated areas of room surfaces. The heating element usually consists of warm water piping, warm air ducts, or electrical resistance elements embedded in or located behind ceiling, wall or floor surfaces.

PELLET FUEL-BURNING APPLIANCE. A closed-combustion, vented *appliance* equipped with a fuel-feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

[W] PERMANENT CONSTRUCTION. Construction that, if removed, would disturb the structural integrity of the building or the fire resistance rating of a building assembly.

[S] PERSON. Any individual, receiver, administrator, executor, assignee, trustee in bankruptcy, trust, estate, firm, partnership, joint venture, club, company, joint stock company, business trust, municipal corporation, political subdivision of the State of Washington, corporation, limited liability company, association, society or any group of individuals acting as a unit, whether mutual, cooperative, fraternal, nonprofit or otherwise, and the United States or any instrumentality thereof.

PIPING. Where used in this code, "piping" refers to either pipe or tubing, or both.

Pipe. A rigid conduit of iron, steel, copper, copper-alloy, or plastic.

Tubing. Semirigid conduit of copper, copper-alloy, aluminum, plastic or steel.

PLASTIC, THERMOPLASTIC. A plastic that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

PLASTIC, THERMOSETTING. A plastic that is capable of being changed into a substantially infusible or insoluble product when cured under application of heat or chemical means.

PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

POLLUTION-CONTROL UNIT (PCU). Manufactured *equipment* that is installed in a grease exhaust duct system for the purpose of extracting smoke, grease particles and odors from the exhaust flow by means of a series of filters.

PORTABLE FUEL CELL APPLIANCE. A fuel cell generator of electricity that is not fixed in place. A portable fuel cell *appliance* utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

[S] ((~~POWER BOILER.~~ ~~See *Boiler.*~~))

[A] PREMISES. A lot, plot or parcel of land, including any structure thereon.

PRESS-CONNECT JOINT. A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion-resistant grip or bite ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.

PRESSURE, FIELD TEST. A test performed in the field to prove system tightness.

PRESSURE RELIEF DEVICE. A pressure-actuated valve or rupture member designed to relieve excessive pressure automatically.

PRESSURE RELIEF VALVE. A pressure-actuated valve held closed by a spring or other means and designed to relieve pressure automatically in excess of the device's setting.

[S] ((~~PRESSURE VESSELS.~~ ~~Closed containers, tanks or vessels that are designed to contain liquids or gases, or both, under pressure.~~))

PRESSURE VESSELS—REFRIGERANT. Any refrigerant-containing receptacle in a refrigerating system. This does not include evaporators where each separate section does not exceed 0.5 cubic foot (0.014 m^3) of refrigerant-containing volume, regardless of the maximum inside dimensions, evaporator coils, controls, headers, pumps and piping.

PRESSURE-LIMITING DEVICE. A pressure-responsive mechanism designed to stop automatically the operation of the pressure-imposing element at a predetermined pressure.

[S] PRODUCT-CONVEYING. Conveying solid particulates, such as refuse, dust, fumes and smoke; liquid particulate matter, such as spray residue, mists and fogs; vapors, such as vapors from flammable or corrosive liquids; noxious and toxic gases; and air at temperatures exceeding 250ºF (121ºC). Examples include, but are not limited to, *combustion* engine, industrial vacuum system, chemical booth, paint booth, paint enclosure and photo lab exhaust.

PROTECTIVE ASSEMBLY (REDUCED CLEARANCE). Any noncombustible assembly that is *labeled* or constructed in accordance with Table 308.4.2 and is placed between combustible materials or assemblies and mechanical *appliances*, devices or *equipment*, for the purpose of reducing required airspace *clearances*. Protective assemblies attached directly to a combustible assembly shall not be considered as part of that combustible assembly.

PURGE. To clear of air, water or other foreign substances.

PUSH-FIT JOINTS. A type of mechanical joint consisting of elastomeric seals and corrosion-resistant tube grippers. Such joints are permanent or removable, depending on the design.

QUICK-OPENING VALVE. A valve that opens completely by fast action, either manually or automatically controlled. A valve requiring one-quarter round turn or less is considered to be quick opening.

RADIANT HEATER. A heater designed to transfer heat primarily by direct radiation.

READY ACCESS (TO). That which enables a device, *appliance* or *equipment* to be directly reached, without requiring the removal or movement of any panel or similar obstruction [see *Access (to)*].

RECEIVER, LIQUID. A vessel permanently connected to a refrigeration system by inlet and outlet pipes for storage of liquid refrigerant.

RECIRCULATED AIR. Air removed from a conditioned space and intended for reuse as supply air.

RECLAIMED REFRIGERANTS. Refrigerants reprocessed to the same specifications as for new refrigerants by means including distillation. Such refrigerants have been chemically analyzed to verify that the specifications have been met. Reclaiming usually implies the use of processes or procedures that are available only at a reprocessing or manufacturing facility.

RECOVERED REFRIGERANTS. Refrigerants removed from a system in any condition without necessarily testing or processing them.

RECYCLED REFRIGERANTS. Refrigerants from which contaminants have been reduced by oil separation, removal of noncondensable gases, and single or multiple passes through devices that reduce moisture, acidity and particulate matter, such as replaceable core filter driers. These procedures usually are performed at the field job site or in a local service shop.

REFRIGERANT. A substance utilized to produce refrigeration by its expansion or vaporization.

REFRIGERANT SAFETY GROUP CLASSIFICATION. The alphabetical/numerical designation that indicates both the toxicity and flammability classifications of refrigerants.

Flammability. See *Flammability classification (Refrigerant)*.

Toxicity. See *Toxicity classification (Refrigerant)*.

REFRIGERATING SYSTEM. A combination of interconnected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat.

REFRIGERATION CAPACITY RATING. Expressed as 1 horsepower (0.75 kW), 1 ton or 12,000 Btu/h (3.5 kW), shall all mean the same quantity.

REFRIGERATION MACHINERY ROOM. See *Machinery room*.

REFRIGERATION SYSTEM, ABSORPTION. A heat-operated, closed-refrigeration cycle in which a secondary fluid (the absorbent) absorbs a primary fluid (the refrigerant) that has been vaporized in the evaporator.

Direct system. A system in which the evaporator is in direct contact with the material or space refrigerated, or is located in air-circulating passages communicating with such spaces.

Indirect system. A system in which a brine coil cooled by the refrigerant is circulated to the material or space refrigerated, or is utilized to cool the air so circulated. Indirect systems are distinguished by the type or method of application.

REFRIGERATION SYSTEM, MECHANICAL. A combination of interconnected refrigeration-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat and in which a compressor is used for compressing the refrigerant vapor.

REFRIGERATION SYSTEM, SELF-CONTAINED. A complete factory-assembled and tested system that is shipped in one or more sections and that does not have refrigerant-containing parts that are joined in the field by other than companion or block valves.

REFRIGERATION SYSTEM CLASSIFICATION. Refrigeration systems are classified according to the degree of probability that leaked refrigerant from a failed connection, seal or component will enter an occupied area. The distinction is based on the basic design or location of the components.

[A] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

[W] RELIEF AIR. Exhausted return air from a system that provides ventilation for human usage.

[W] REPLACEMENT AIR. Outdoor air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: Makeup air, supply air, transfer air, and infiltration. However, the ultimate source of all replacement air is outdoor air. When replacement air exceeds exhaust, the result is exfiltration.

RETURN AIR. Air removed from an *approved* conditioned space or location and recirculated or exhausted.

RETURN AIR SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers and grilles through which air from the space or spaces to be heated or cooled is conducted back to the supply unit (see also *Supply air system*).

[FG] ROOM HEATER, VENTED. A free-standing heating unit burning solid or liquid fuel for direct heating of the space in and adjacent to that in which the unit is located.

SAFETY VALVE. A valve that relieves pressure in a steam boiler by opening fully at the rated discharge pressure. The valve is of the spring-pop type.

SELF-CONTAINED EQUIPMENT. Complete, factory-assembled and tested, heating, air-conditioning or refrigeration *equipment* installed as a single unit, and having all working parts, complete with motive power, in an enclosed unit of said machinery.

[BF] SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and the roof.

[BF] SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

[A] SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a *dwelling unit* are not *sleeping units*.

[BF] SMOKE DAMPER. A *listed* device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

[BF] SMOKE-DEVELOPED INDEX. A numerical value assigned to a material tested in accordance with ASTM E84.

SOLAR THERMAL SYSTEM. A system that converts solar radiation to thermal energy for use in heating or cooling.

SOLID FUEL (COOKING APPLICATIONS). Applicable to commercial food service operations only, solid fuel is any bulk material such as hardwood, mesquite, charcoal or briquettes that is combusted to produce heat for cooking operations.

SOURCE CAPTURE SYSTEM. A mechanical exhaust system designed and constructed to capture air contaminants at their source and to exhaust such contaminants to the outdoor atmosphere.

[FG] STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages that constitute an automatically operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

[S] ((~~STEAM-HEATING BOILER.~~ ~~A boiler operated at pressures not exceeding 15 psi (103 kPa) for steam.~~))

STOP VALVE. A shutoff valve for controlling the flow of liquid or gases.

[BG] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor next above, except that the topmost story shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above.

STRENGTH, ULTIMATE. The highest stress level that the component will tolerate without rupture.

SUPPLY AIR. That air delivered to each or any space supplied by the air distribution system or the total air delivered to all spaces supplied by the air distribution system, which is provided for ventilating, heating, cooling, humidification, dehumidification and other similar purposes.

SUPPLY AIR SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers and grilles through which air, heated or cooled, is conducted from the supply unit to the space or spaces to be heated or cooled (see also *Return air system*).

THEORETICAL AIR. The exact amount of air required to supply oxygen for complete *combustion* of a given quantity of a specific fuel.

THERMAL RESISTANCE (*R*). A measure of the ability to retard the flow of heat. The *R*-value is the reciprocal of thermal conductance.

[S] THIMBLE. A *listed* fitting designed to be installed in the opening in a masonry *chimney* through which the *chimney* connector passes.

[P] THIRD-PARTY CERTIFICATION AGENCY. An approved agency operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

[P] THIRD-PARTY CERTIFIED. Certification obtained by the manufacturer indicating that the function and performance characteristics of a product or material have been determined by testing and ongoing surveillance by an approved third-party certification agency. Assertion of certification is in the form of identification in accordance with the requirements of the third-party certification agency.

[P] THIRD-PARTY TESTED. Procedure by which an approved testing laboratory provides documentation that a product, material or system conforms to specified requirements.

TLV-TWA (THRESHOLD LIMIT VALUE-TIME-WEIGHTED AVERAGE). The time-weighted average concentration of a refrigerant or other chemical in air for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers are repeatedly exposed, day after day, without adverse effects, as adopted by the American Conference of Government Industrial Hygienists (ACGIH).

TOILET ROOM. A room containing a water closet and, frequently, a lavatory, but not a bathtub, shower, spa or similar bathing fixture.

TOXICITY CLASSIFICATION (REFRIGERANT). An alphabetical designation used to identify the toxicity of refrigerants. Class A indicates a refrigerant with low toxicity. Class B indicates a refrigerant with high toxicity.

TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter for joining plastic pipe to steel pipe. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials that cannot be joined directly one to another.

[S] UNCONFINED SPACE. A space having a volume not less than 50 cubic feet per 1,000 Btu/h ($4.8 m^3/kW$) of the aggregate input rating of all fuel-burning appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

[FG] UNIT HEATER. A self-contained *appliance* of the fan type, designed for the delivery of warm air directly into the space in which the *appliance* is located.

[S] UNSAFE. Constituting a fire or health hazard or otherwise dangerous to human life, constituting a hazard to safety, health or public welfare.

UNVENTED ALCOHOL FUEL-BURNING DECORATIVE APPLIANCE. A stationary, self-contained *appliance* intended to be directly or indirectly secured to a wall or floor and not intended for duct connection. Such *appliance* burns alcohol and is made in a manufacturing facility for subsequent delivery to the installation site.

VENT. A pipe or other conduit composed of factory-made components, containing a passageway for conveying *combustion* products and air to the atmosphere, *listed* and *labeled* for use with a specific type or class of *appliance*.

Pellet vent. A vent *listed* and *labeled* for use with *listed* pellet-fuel-burning *appliances*.

Type L vent. A vent *listed* and *labeled* for use with the following:

1. Oil-burning *appliances* that are *listed* for use with Type L vents.
2. Gas-fired *appliances* that are *listed* for use with Type B vents.

VENT CONNECTOR. The pipe that connects an *approved* fuel-fired *appliance* to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual automatically operated fuel-burning *appliance* that is designed to open the venting system automatically when the *appliance* is in operation and to close off the venting system automatically when the *appliance* is in a standby or shutdown condition.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTILATION AIR. That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

[W] VENTILATION ZONE. Any indoor area that requires ventilation and comprises one or more spaces with the same occupancy category (see Table 403.3.1.1), occupant density, zone air distribution effectiveness (see Section 403.3.1.1.1.2), and design zone primary airflow per unit area.

[FG] VENTING SYSTEM. A continuous open passageway from the flue collar of an *appliance* to the outdoor atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a *chimney* and vent connector, if used, assembled to form the open passageway.

[S] WATER HEATER. Any listed heating *appliance* or *equipment* that heats potable water and supplies such water to the potable hot water distribution system ((.)) excluding any *appliance* or *equipment* that exceeds any of the following:

1. An operating temperature of 210 degrees F (99 degrees C);
2. A maximum allowable working pressure of 160 pounds per square inch (1103 kPa);
3. A volume of 120 gallons (454 L); or
4. A heat input of 200,000 Btu/hr (58.6 kW).

Any *appliance* or *equipment* that exceeds any one of these values is classified as a boiler.

[W] WHOLE HOUSE VENTILATION SYSTEM. A mechanical ventilation system, including fans, controls, and ducts, which replaces by direct means, air from the habitable rooms with outdoor air.

ZONE. One *occupiable space* or several occupiable spaces with similar *occupancy* classification (see Table 403.3.1.1), occupant density, zone air distribution effectiveness and zone primary airflow rate per unit area.

CHAPTER 3

GENERAL REGULATIONS

User note:

About this chapter: *Chapter 3 contains broadly applicable requirements that are necessarily placed in an overarching "general" chapter. These general requirements would not be suitably located in any other chapter that is specific to unique subject matter. General requirements include those related to installation, access, location, testing, structural and clearances.*

SECTION 301
GENERAL

[S] 301.1 Scope. This chapter shall govern the approval and installation of all *equipment* and *appliances* that comprise parts of the building mechanical systems regulated by this code in accordance with Section ((~~101.2~~)) 103.1.

Note: Seattle Energy Code Section C403.1.4 restricts the use of electric resistance and fossil fuel-fired equipment for HVAC heating in most buildings, and Section C404.2.1 restricts the use of electric resistance and fossil fuel-fired service water heating equipment in Group R-1 and R-2 buildings.

301.2 Energy utilization. Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *International Energy Conservation Code*.

301.3 Identification. Each length of pipe and tubing and each pipe fitting utilized in a mechanical system shall bear the identification of the manufacturer.

301.4 Plastic pipe, fittings and components. Plastic pipe, fittings and components shall be *third-party certified* as conforming to NSF 14.

301.5 Third-party testing and certification. Piping, tubing and fittings shall comply with the applicable referenced standards, specifications and performance criteria of this code and shall be identified in accordance with Section 301.3. Piping, tubing and fittings shall either be tested by an approved third-party testing agency or certified by an approved *third-party certification agency*.

301.6 Fuel gas appliances and equipment. The approval and installation of fuel gas distribution piping and *equipment*, fuel gas-fired *appliances* and fuel gas-fired *appliance* venting systems shall be in accordance with the *International Fuel Gas Code*.

[S] 301.7 Listed and labeled. *Appliances* regulated by this code shall be *listed* and *labeled* for the application in which they are installed and used, unless otherwise *approved* in accordance with Section 105 or 106.

Exception: Listing and labeling of *equipment* and *appliances* used for refrigeration shall be in accordance with Section 1101.2.

301.8 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.8.1 through 301.8.2.3.

301.8.1 Testing. An *approved* agency shall test a representative sample of the mechanical *equipment* and *appliances* being *labeled* to the relevant standard or standards. The *approved* agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

301.8.2 Inspection and identification. The *approved* agency shall periodically perform an inspection, which shall be in-plant if necessary, of the mechanical *equipment* and *appliances* to be *labeled*. The inspection shall verify that the *labeled* mechanical *equipment* and *appliances* are representative of the mechanical *equipment* and *appliances* tested.

301.8.2.1 Independent. The agency to be *approved* shall be objective and competent. To confirm its objectivity, the agency shall disclose all possible conflicts of interest.

301.8.2.2 Equipment. An *approved* agency shall have adequate *equipment* to perform all required tests. The *equipment* shall be periodically calibrated.

301.8.2.3 Personnel. An *approved* agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

301.9 Label information. A permanent factory-applied nameplate(s) shall be affixed to *appliances* on which shall appear in legible lettering, the manufacturer's name or trademark, the model number, serial number and the seal or mark of the *approved* agency. A label shall include the following:

1. Electrical *equipment* and *appliances*: Electrical rating in volts, amperes and motor phase; identification of individual electrical components in volts, amperes or watts, motor phase; Btu/h (W) output; and required clearances.
2. Absorption units: Hourly rating in Btu/h (W); minimum hourly rating for units having step or automatic modulating controls; type of fuel; type of refrigerant; cooling capacity in Btu/h (W); and required clearances.
3. Fuel-burning units: Hourly rating in Btu/h (W); type of fuel *approved* for use with the *appliance*; and required clearances.
4. Electric comfort heating *appliances*: electric rating in volts, amperes and phase; Btu/h (W) output rating; individual marking for each electrical component in amperes or watts, volts and phase; and required *clearances* from combustibles.

[S] 301.10 Electrical. Electrical wiring, controls and connections to *equipment* and *appliances* regulated by this code shall be in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[S] 301.11 Plumbing connections. Potable water supply and building drainage system connections to *equipment* and *appliances* regulated by this code shall be in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

301.12 Fuel types. Fuel-fired *appliances* shall be designed for use with the type of fuel to which they will be connected and the altitude at which they are installed. *Appliances* that comprise parts of the building mechanical system shall not be converted for the usage of a different fuel, except where *approved* and converted in accordance with the manufacturer's instructions. The fuel input rate shall not be increased or decreased beyond the limit rating for the altitude at which the *appliance* is installed.

301.13 Vibration isolation. Where vibration isolation of *equipment* and *appliances* is employed, an *approved* means of supplemental restraint shall be used to accomplish the support and restraint.

301.14 Repair. Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

301.15 Wind resistance. Mechanical *equipment*, *appliances* and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *International Building Code*.

[BS] 301.16 Flood hazard. For structures located in flood hazard areas, mechanical systems, equipment and *appliances* shall be located at or above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant *equipment*.

Exception: Mechanical systems, *equipment* and *appliances* are permitted to be located below the elevation required by Section 1612 of the of the *International Building Code* for utilities and attendant equipment provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

[BS] 301.16.1 Coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones, mechanical systems and *equipment* shall not be mounted on or penetrate walls intended to break away under flood loads.

301.17 Rodentproofing. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entrance of rodents in accordance with the *International Building Code*.

301.18 Seismic resistance. Where earthquake loads are applicable in accordance with the *International Building Code*, mechanical system supports, anchorage and bracing shall be designed and installed for seismic forces in accordance with Chapter 16 of the *International Building Code*.

SECTION 302
PROTECTION OF STRUCTURE

302.1 Structural safety. The building or structure shall not be weakened by the installation of mechanical systems. Where floors, walls, ceilings or any other portion of the building or structure are required to be altered or replaced in the process of installing or repairing any system, the building or structure shall be left in a safe structural condition in accordance with the *International Building Code*.

302.2 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with Chapter 7 of the *International Building Code*.

[BS] 302.3 Cutting, notching and boring in wood framing. The cutting, notching and boring of wood framing members shall comply with Sections 302.3.1 through 302.3.4.

[BS] 302.3.1 Joist notching. Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed

with the exterior door air leakage requirements of the *International Energy Conservation Code* and equipped with an *approved* self-closing device.

303.4 Protection from damage. *Appliances* shall not be installed in a location where subject to mechanical damage unless protected by *approved* barriers.

303.5 Indoor locations. Furnaces and boilers installed in closets and alcoves shall be listed for such installation.

303.6 Outdoor locations. *Appliances* installed in other than indoor locations shall be *listed* and *labeled* for outdoor installation.

[S] 303.7 Pit locations. *Appliances* installed in pits or excavations shall not come in direct contact with the surrounding soil and shall be installed not less than 3 inches (76 mm) above the pit floor. The sides of the pit or excavation shall be held back not less than 12 inches (305 mm) from the *appliance*, and a minimum of 30 inches (762 mm) on the control side. Where the depth exceeds 12 inches (305 mm) below adjoining grade, the walls of the pit or excavation shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 4 inches (102 mm) above adjoining grade and shall have sufficient lateral load-bearing capacity to resist collapse. Excavation on the control side of the *appliance* shall extend not less than 30 inches (762 mm) horizontally. The *appliance* shall be protected from flooding in an *approved* manner.

[S][BF] 303.8 ((~~Elevator shafts~~)) Temperature control and installation of pipes or ducts conveying gases, vapors or liquids in hoistways, machine rooms, control rooms or machinery spaces for elevators. ((~~Mechanical systems shall not be located in an elevator shaft.~~)) Temperature control in machine rooms, control rooms and machinery spaces for elevators shall be provided per Seattle Building Code Section 3020.7. Pipes and ducts conveying gases, vapors or liquids shall not be installed in elevator hoistways, elevator machine rooms, control rooms and elevator machinery spaces unless allowed per Seattle Building Code Section 3022.2.

Exceptions:

1. Only ducts for heating, cooling, ventilating, and venting these spaces are permitted to be installed in the hoistway, machine room, and machinery space.
2. Ducts and electrical conduit may pass through an elevator machine room or machinery space if they are separated from the room or space by construction equal to the rated construction of the room or space and located so that all required *clearances* are maintained.

   If a vented machine room is not vented directly to the outside of the building, the vent shall be enclosed within a fire barrier with at least a one-hour fire-resistance rating, or as required for a shaft where it passes through occupied floors.
3. Standard sprinkler protection conforming to the requirements of NFPA 13 is permitted to be installed in these spaces, subject to rules promulgated by the code official.
4. Subject to the approval of the code official, pipes that are protected with double containment whose joints are threaded, soldered or welded joints are permitted. Pipes shall not be located less than 7 feet above the floor in machine rooms.

303.9 Fireplaces in Group I-2, Condition 2 occupancies. Fuel-burning *appliances* and fireplaces in Group I-2, Condition 2 *occupancies* shall be in accordance with Section 901.4.

[S][B] 303.10 Interior exit stairways and exit passageways. Mechanical systems shall not be located in *interior exit stairways* and ramps and *exit passageways*. Penetrations into and openings through *interior exit stairways* and ramps and *exit passageways* are prohibited except for:

1. *Equipment* allowed or required by the International Building Code to serve the *interior exit stairway* and *exit passageways* such as:
   1.1. Ductwork and *equipment* necessary for independent ventilation or stairway pressurization,
   1.2. Sprinkler piping,
   1.3. Standpipes,
   1.4. Electrical raceway serving the *interior exit stairway* or ramp terminating in a steel box not exceeding 16 square inches (10 323 mm^2) in area, and
   1.5. Piping used exclusively for the drainage of rainfall runoff from roof areas provided the roof is not used for a helistop or heliport.
2. Unfired heaters allowed by the *International Building Code* for freeze protection of fire protection *equipment* may penetrate one protective membrane. The conduit serving the heater may penetrate both protective membranes. Such penetrations shall be protected in accordance with *International Building Code* Section 714. There shall be no penetrations or communicating openings, whether protected or not, between adjacent *interior exit stairways* and ramps.

Exception: Membrane penetrations shall be permitted on the outside of the *interior exit stairway* and ramp. Such penetrations shall be protected in accordance with *International Building Code* Section 714.4.4.2.

Interpretation: Ducts passing through *interior exit stairways* shall be separated from the stairway by construction having a fire-resistance rating at least equal to the stairway walls. At least one side of the duct enclosure shall abut the *interior exit stairway* enclosure.

SECTION 304
INSTALLATION

304.1 General. *Equipment* and *appliances* shall be installed as required by the terms of their approval, in accordance with the conditions of the listing, the manufacturer's installation instructions and this code. Manufacturer's installation instructions shall be available on the job site at the time of inspection.

304.2 Conflicts. Where conflicts between this code and the conditions of listing or the manufacturer's installation instructions occur, the provisions of this code shall apply.

Exception: Where a code provision is less restrictive than the conditions of the listing of the *equipment* or *appliance* or the manufacturer's installation instructions, the conditions of the listing and the manufacturer's installation instructions shall apply.

304.3 Elevation of ignition source. *Equipment* and *appliances* having an *ignition source* and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the *equipment* or *appliance* rests. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exception: Elevation of the ignition source is not required for *appliances* that are listed as flammable vapor ignition resistant.

[S] 304.3.1 Parking garages. Connection of a parking garage with any room in which there is a fuel-fired *appliance* shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the *appliance* are elevated in accordance with Section 304.3.

Exception: This section shall not apply to *appliance* installations complying with Section 304.6 or to *equipment* having an internal *combustion* engine.

304.4 Prohibited equipment and appliance location. *Equipment* and *appliances* having an *ignition source* shall not be installed in Group H *occupancies* or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs.

[FG] 304.5 Hydrogen-generating and refueling operations. Hydrogen-generating and refueling *appliances* shall be installed and located in accordance with their listing and the manufacturer's instructions. Ventilation shall be required in accordance with Section 304.5.1, 304.5.2 or 304.5.3 in public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages that contain hydrogen-generating *appliances* or refueling systems. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

[FG] 304.5.1 Natural ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be limited to a maximum floor area of 850 square feet (79 m^2) and shall communicate with the outdoors in accordance with Sections 304.5.1.1 and 304.5.1.2. The maximum rated output capacity of hydrogen-generating *appliances* shall not exceed 4 standard cubic feet per minute (0.00189 m^3/s) of hydrogen for each 250 square feet (23 m^2) of floor area in such spaces. The minimum cross-sectional dimension of air openings shall be 3 inches (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In such locations, *equipment* and *appliances* having an *ignition source* shall be located such that the source of ignition is not within 12 inches (305 mm) of the ceiling.

[FG] 304.5.1.1 Two openings. Two permanent openings shall be provided within the garage. The upper opening shall be located entirely within 12 inches (305 mm) of the ceiling of the garage. The lower opening shall be located entirely within 12 inches (305 mm) of the floor of the garage. Both openings shall be provided in the same exterior wall. The openings shall communicate directly with the outdoors and shall have a minimum free area of 1/2 square foot per 1,000 cubic feet (1 m^2/610 m^3) of garage volume.

[FG] 304.5.1.2 Louvers and grilles. In calculating free area required by Section 304.5.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not

known, it shall be assumed that wood louvers will have 25-percent free area and metal louvers and grilles will have 75-percent free area. Louvers and grilles shall be fixed in the open position.

[FG] 304.5.2 Mechanical ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be ventilated in accordance with Section 502.16. In such locations, *equipment* and *appliances* having an *ignition source* shall be located such that the source of ignition is below the mechanical ventilation outlet(s).

[FG] 304.5.3 Specially engineered installations. As an alternative to the provisions of Sections 304.5.1 and 304.5.2, the necessary supply of air for ventilation and dilution of flammable gases shall be provided by an *approved* engineered system.

304.6 Public garages. *Appliances* located in public garages, motor fuel-dispensing facilities, repair garages or other areas frequented by motor vehicles, shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an *appliance*, the *appliance* shall be installed at the *clearances* required by the *appliance* manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.

Exception: The requirements of this section shall not apply where the *appliances* are protected from motor vehicle impact and installed in accordance with Section 304.3 and NFPA 30A.

304.7 Private garages. *Appliances* located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.

Exception: The requirements of this section shall not apply where the *appliances* are protected from motor vehicle impact and installed in accordance with Section 304.3.

304.8 Construction and protection. Boiler rooms and furnace rooms shall be protected as required by the *International Building Code*.

304.9 Clearances to combustible construction. Heat-producing *equipment* and *appliances* shall be installed to maintain the required *clearances* to combustible construction as specified in the listing and manufacturer's instructions. Such *clearances* shall be reduced only in accordance with Section 308. *Clearances* to combustibles shall include such considerations as door swing, drawer pull, overhead projections or shelving and window swing, shutters, coverings and drapes. Devices such as door-stops or limits, closers, drapery ties or guards shall not be used to provide the required *clearances*.

304.10 Clearances from grade. *Equipment* and *appliances* installed at grade level shall be supported on a level concrete slab or other *approved* material extending not less than 3 inches (76 mm) above adjoining grade or shall be suspended not less than 6 inches (152 mm) above adjoining grade. Such support shall be in accordance with the manufacturer's installation instructions.

[BE] 304.11 Guards. Guards shall be provided where various components that require service and roof hatch openings are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof, or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of components that require service and each end of the roof hatch parallel to the roof edge. The top of the guard shall be located not less than 42 inches (1067 mm) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*.

Exception: Guards are not required where fall arrest/restraint anchorage connector devices that comply with ANSI/ASSP Z359.1 are installed.

304.12 Area served. *Appliances* serving different areas of a building other than where they are installed shall be permanently marked in an *approved* manner that uniquely identifies the *appliance* and the area it serves.

[S] 304.13 Clearances and encroachments in the public right-of-way. All encroachments of *equipment* and appliances on, over or under sidewalks, streets, alleys and other public places are subject to approval by the Director of Transportation and the *code official*. Encroachments shall comply with this code and other codes as determined by the Director of Transportation and the *code official*.

Note: The Seattle Department of Transportation (SDOT) publishes the "Seattle Right-of-Way Improvements Manual" that contains detailed information on *clearances* (subsection 3.3, Clearances), and required SDOT street use permits (Chapter 4). SDOT discourages encroachments into the public right-of-way by mechanical *equipment*.

SECTION 305
PIPING SUPPORT

305.1 General. Mechanical system piping shall be supported in accordance with this section.

306.3 Appliances in attics. Attics containing *appliances* shall be provided with an opening and unobstructed passageway large enough to allow removal of the largest *appliance*. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the *appliance*. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the *appliance*. The clear access opening dimensions shall be not less than 20 inches by 30 inches (508 mm by 762 mm), and large enough to allow removal of the largest *appliance*.

Exceptions:

1. The passageway and level service space are not required where the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is unobstructed and not less than 6 feet (1829 mm) high and 22 inches (559 mm) wide for its entire length, the passageway shall be not greater than 50 feet (15 250 mm) in length.

[S] 306.3.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

306.4 Appliances under floors. Underfloor spaces containing *appliances* shall be provided with an access opening and unobstructed passageway large enough to remove the largest *appliance*. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide, nor more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the *appliance*. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the *appliance*. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 4 inches (102 mm) above the adjoining grade and shall have sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be not less than 22 inches by 30 inches (559 mm by 762 mm), and large enough to allow removal of the largest *appliance*.

Exceptions:

1. The passageway is not required where the level service space is present when the access is open and the *appliance* is capable of being serviced and removed through the required opening.
2. Where the passageway is unobstructed and not less than 6 feet high (1929 mm) and 22 inches (559 mm) wide for its entire length, the passageway shall not be limited in length.

[S] 306.4.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the *appliance* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[W][S] 306.5 Equipment and appliances on roofs or elevated structures. Where *equipment* or appliances requiring access ((~~or *appliances*~~)) are located on an elevated structure or the roof of a building such that personnel will have to climb higher than 16 feet (4877 mm) above grade to access such *equipment* or *appliances*, an interior or exterior means of access shall be provided. Such access shall not require climbing over obstructions greater than 30 inches (762 mm) in height or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope). Such access shall not require the use of portable ladders. Where access involves climbing over parapet walls, the height shall be measured to the top of the parapet wall.

Permanent ladders installed to provide the required access shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than ((~~30~~)) 42 inches (((~~762~~)) 1067 mm).
2. Ladders shall have rung spacing not to exceed ((~~14~~)) 12 inches (((~~356~~)) 305 mm) on center. The uppermost rung shall be ((~~not greater than~~)) a maximum of 24 inches (610 mm) below the upper edge of the roof hatch, roof or parapet, as applicable.
3. Ladders shall have a toe spacing not less than ((~~6~~)) 7 inches (((~~152~~)) 178 mm) deep.
4. There shall be not less than 18 inches (457 mm) between rails.
5. Rungs shall have a diameter not less than 0.75-inch (19.1 mm) and be capable of withstanding a 300-pound (136 kg) load.
6. Ladders over 30 feet (9144 mm) in height shall be provided with offset sections and landings capable of withstanding 100 pounds per square foot (488 kg/m^2). Landing dimensions shall be not less than 18 inches (457 mm) and not less than the width of the ladder served. A guard rail shall be provided on all open sides of the landing.
7. Climbing clearance. The distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be not less than 30 inches (762 mm) measured perpendicular to the rungs. This distance shall be maintained from the point of ladder access to the bottom of the roof hatch. A minimum clear width of 15 inches (381

mm) shall be provided on both sides of the ladder measured from the midpoint of and parallel with the rungs except where cages or wells are installed.

8. Landing required. The ladder shall be provided with a clear and unobstructed bottom landing area having a minimum dimension of 30 inches (762 mm) by 30 inches (762 mm) centered in front of the ladder.
9. Ladders shall be protected against corrosion by *approved* means.
10. Access to ladders shall be provided at all times.

Catwalks installed to provide the required access shall be not less than 24 inches (610 mm) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 *occupancies*.

Interpretation I306.5: Item 10 allows access to ladders to be restricted to authorized personnel and prohibits storage that blocks or restricts access to the ladder.

306.5.1 Sloped roofs. Where *appliances*, *equipment*, fans or other components that require service are installed on a roof having a slope of 3 units vertical in 12 units horizontal (25-percent slope) or greater and having an edge more than 30 inches (762 mm) above grade at such edge, a level platform shall be provided on each side of the *appliance* or *equipment* to which access is required for service, repair or maintenance. The platform shall be not less than 30 inches (762 mm) in any dimension and shall be provided with guards. The guards shall extend not less than 42 inches (1067 mm) above the platform, shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*. Access shall not require walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope). Where access involves obstructions greater than 30 inches (762 mm) in height, such obstructions shall be provided with ladders installed in accordance with Section 306.5 or stairways installed in accordance with the requirements specified in the *International Building Code* in the path of travel to and from *appliances*, fans or *equipment* requiring service.

[S] 306.5.2 Electrical requirements. A receptacle outlet shall be provided at or near the *equipment* location in accordance with ((~~NFPA 70~~)) the *Seattle Electrical Code*.

[W] 306.6 Appliances above ceilings. Appliances that are located above ceilings shall have ready access for inspection, service and repair without removing *permanent construction*. Appliances that are located above a ceiling shall be provided with access to the working space(s) by an opening not smaller than 22 inches by 22 inches (559 mm by 559 mm). All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.

The appliance is not required to be removable or replaceable through the enclosure door, hinged panel, removable lay-in ceiling tile, or other removable covers. The appliance may be removed or replaced by removing the ceiling or wall assemblies adjacent to the appliance as long as they are not *permanent construction*.

Exceptions:

1. This section shall not apply to replacement appliances installed in existing compartments and alcoves where the working space clearances are in accordance with the appliance manufacturer's installation instructions.
2. A smaller enclosure door, hinged panel, removable lay-in ceiling tile, or other removable covers shall be permitted when allowed by the appliance manufacturer's installation instructions and electrical access is not required.

SECTION 307
CONDENSATE DISPOSAL

[S] 307.1 Fuel-burning appliances. Liquid *combustion* by-products of condensing *appliances* shall be collected, pH neutralized and discharged to an *approved* plumbing fixture or disposal area in accordance with the manufacturer's installation instructions. Condensate piping shall be of *approved* corrosion-resistant material and shall not be smaller than the drain connection on the *appliance*. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1-percent slope).

307.1.1 Identification. The termination of concealed condensate piping shall be marked to indicate whether the piping is connected to the primary or secondary drain.

307.2 Evaporators and cooling coils. Condensate drain systems shall be provided for *equipment* and *appliances* containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 307.2.1 through 307.2.5.

Exception: Evaporators and cooling coils that are designed to operate in sensible cooling only and not support condensation shall not be required to meet the requirements of this section.

307.2.1 Condensate disposal. Condensate from all cooling coils and evaporators shall be conveyed from the drain pan outlet to an *approved* place of disposal. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1-percent slope). Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

[S] 307.2.1.1 Condensate discharge. Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, ((~~trench drain,~~)) mop sink, hub drain, standpipe, utility sink or laundry sink or other *approved* locations in accordance with the Seattle Plumbing Code. Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture. Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within, or controlled by, the same occupancy, tenant space or *dwelling unit* as the source of the condensate.

[S] 307.2.2 Drain pipe materials and sizes. Components of the condensate disposal system shall be ABS, cast iron, copper and copper alloy, CPVC, cross-linked polyethylene, galvanized steel, PE-RT, polyethylene, polypropylene, PVC or PVDF pipe or tubing. Components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the applicable provisions of ((~~Chapter 7 of~~)) the ((~~*International*~~)) *Uniform Plumbing Code* relative to the material type. Condensate waste and drain line size shall be not less than 3/4-inch pipe size and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with Table 307.2.2.

TABLE 307.2.2
CONDENSATE DRAIN SIZING

EQUIPMENT CAPACITY	MINIMUM CONDENSATE PIPE DIAMETER
Up to 20 tons of refrigeration	3/4 inch
Over 20 tons to 40 tons of refrigeration	1 inch
Over 40 tons to 90 tons of refrigeration	1-1/4 inch
Over 90 tons to 125 tons of refrigeration	1-1/2 inch
Over 125 tons to 250 tons of refrigeration	2 inch

For SI: 1 inch = 25.4 mm, 1 ton = 3.517 kW.

[W] 307.2.3 Auxiliary and secondary drain systems. In addition to the requirements of Section 307.2.1, where damage to any building components could occur as a result of overflow from the *equipment* primary condensate removal system, one of the following auxiliary protection methods shall be provided for each cooling coil or fuel-fired *appliance* that produces condensate:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1-1/2 inches (38 mm), shall be not less than 3 inches (76 mm) larger than the unit, or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Galvanized sheet steel pans shall have a minimum thickness of not less than 0.0236 inch (0.6010 mm) (No. 24 gage). Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
2. A separate overflow drain line shall be connected to the drain pan provided with the *equipment*. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the *equipment* served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
4. A water-level detection device conforming to UL 508 shall be provided that will shut off the *equipment* served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

Exceptions:

1. Fuel-fired *appliances* that automatically shut down operation in the event of a stoppage in the condensate drainage system.
2. Unducted fan coil units where there is no factory option available for water-level detection devices and which are installed directly within the occupied space.

[S] 307.2.3.1 Water-level monitoring devices. On down-flow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the *equipment* served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.

Exception: Water-level monitoring devices are not required for unducted fan coil units where there is no factory option available for water-level detection devices and the units are installed directly within the occupied space.

307.2.3.2 Appliance, equipment and insulation in pans. Where *appliances*, *equipment* or insulation are subject to water damage when auxiliary drain pans fill, that portion of the *appliance*, *equipment* and insulation shall be installed above the rim of the pan. Supports located inside of the pan to support the *appliance* or *equipment* shall be water resistant and *approved*.

307.2.3.3 Identification. The termination of concealed condensate piping shall be marked to indicate whether the piping is connected to the primary or secondary drain.

307.2.4 Traps. Condensate drains shall be trapped as required by the *equipment* or *appliance* manufacturer.

[W] 307.2.4.1 Ductless mini-split system traps. Ductless mini-split *equipment* that produces condensate shall be provided with an inline check valve located in the drain line, ((~~or~~)) a trap, or other means of condensate drainage in accordance with the manufacturer's instructions.

307.2.5 Drain line maintenance. Condensate drain lines shall be configured to permit the clearing of blockages and performance of maintenance without requiring the drain line to be cut.

307.3 Condensate pumps. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the *appliance* or *equipment* served such that when the pump fails, the *appliance* or *equipment* will be prevented from operating. Pumps shall be installed in accordance with the manufacturer's instructions.

SECTION 308
CLEARANCE REDUCTION

308.1 Scope. This section shall govern the reduction in required *clearances* to combustible materials and combustible assemblies for *chimneys,* vents, kitchen exhaust *equipment*, mechanical *appliances*, and mechanical devices and *equipment*.

308.2 Listed appliances and equipment. The reduction of the required *clearances* to combustibles for *listed* and *labeled appliances* and *equipment* shall be in accordance with the requirements of this section except that such *clearances* shall not be reduced where reduction is specifically prohibited by the terms of the *appliance* or *equipment* listing.

308.3 Protective assembly construction and installation. Reduced *clearance* protective assemblies, including structural and support elements, shall be constructed of noncombustible materials. Spacers utilized to maintain an airspace between the protective assembly and the protected material or assembly shall be noncombustible. Where a space between the protective assembly and protected combustible material or assembly is specified, the same space shall be provided around the edges of the protective assembly and the spacers shall be placed so as to allow air circulation by convection in such space. Protective assemblies shall not be placed less than 1 inch (25 mm) from the mechanical *appliances*, devices or *equipment*, regardless of the allowable reduced *clearance*.

308.4 Allowable reduction. The reduction of required *clearances* to combustible assemblies or combustible materials shall be based on the utilization of a reduced *clearance* protective assembly in accordance with Section 308.4.1 or 308.4.2.

308.4.1 Labeled assemblies. The allowable *clearance* reduction shall be based on an approved reduced *clearance* protective assembly that is *listed* and *labeled* in accordance with UL 1618.

308.4.2 Reduction table. The allowable *clearance* reduction shall be based on one of the methods specified in Table 308.4.2. Where required *clearances* are not listed in Table 308.4.2, the reduced *clearances* shall be determined by linear interpolation between the distances listed in the table. Reduced *clearances* shall not be derived by extrapolation below the range of the table.

308.4.2.1 Solid fuel-burning appliances. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearance* required for solid fuel-burning *appliances* that are *labeled* for installation with *clearances* of 12 inches (305 mm) or less. Where *appliances* are *labeled* for installation with *clearances* of greater than 12 inches (305 mm), the *clearance* reduction methods of Table 308.4.2 shall not reduce the *clearance* to less than 12 inches (305 mm).

308.4.2.2 Masonry chimneys. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearances* required for masonry *chimneys* as specified in Chapter 8 and the *International Building Code*.

308.4.2.3 Chimney connector pass-throughs. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearances* required for *chimney* connector pass-throughs as specified in Section 803.10.4.

308.4.2.4 Masonry fireplaces. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the *clearances* required for masonry fireplaces as specified in Chapter 8 and the *International Building Code*.

308.4.2.5 Kitchen exhaust ducts. The *clearance* reduction methods specified in Table 308.4.2 shall not be utilized to reduce the minimum *clearances* required by Section 506.3.11.1 for kitchen exhaust ducts enclosed in a shaft.

TABLE 308.4.2
CLEARANCE REDUCTION METHODS[b]

TYPE OF PROTECTIVE ASSEMBLY[a]	REDUCED CLEARANCE WITH PROTECTION (inches)[a]							
	Horizontal combustible assemblies located above the heat source				Horizontal combustible assemblies located beneath the heat source and all vertical combustible assemblies			
	Required clearance to combustibles without protection (inches)[a]				Required clearance to combustibles without protection (inches)			
	36	18	9	6	36	18	9	6
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), mounted on 1-inch glass fiber or mineral wool batt reinforced with wire on the back, 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	2
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having 1 inch of fiberglass insulation between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
0.5-inch inorganic insulating board, over 1 inch of fiberglass or mineral wool batt, against the combustible assembly	24	12	6	4	18	9	5	3
3-1/2-inch brick wall, spaced 1 inch off the combustible wall	—	—	—	—	12	6	6	6
3-1/2-inch brick wall, against the combustible wall	—	—	—	—	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F) – 32]/1.8, 1 pound per cubic foot = 16.02 kg/m^3, 1.0 Btu • in/(ft^2 • h • °F) = 0.144 W/m^2 • K.

a. Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 1.0 Btu • in/(ft^2 • h • °F) or less. Insulation board shall be formed of noncombustible material.

b. For limitations on clearance reduction for solid fuel-burning appliances, masonry chimneys, connector pass-throughs, masonry fireplaces and kitchen ducts, see Sections 308.4.2.1 through 308.4.2.5.

SECTION 309
TEMPERATURE CONTROL

[S][BG] 309.1 Space-heating systems. Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining an average indoor temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above floor ((~~on the design heating day~~)) when the outside temperature is 24°F. The installation of portable space heaters shall not be used to achieve compliance with this section.

Exceptions:

1. Interior spaces where the primary purpose is not associated with human comfort.
2. Group F, H, S and U *occupancies*.

SECTION 310
EXPLOSION CONTROL

[F] 310.1 Required. Structures occupied for purposes involving explosion hazards shall be provided with explosion control where required by the *International Fire Code*. Explosion control systems shall be designed and installed in accordance with Section 911 of the *International Fire Code*.

SECTION 311
SMOKE AND HEAT VENTS

[F] 311.1 Required. *Approved* smoke and heat vents shall be installed in the roofs of one-story buildings where required by the *International Fire Code*. Smoke and heat vents shall be designed and installed in accordance with the *International Fire Code*.

SECTION 312
HEATING AND COOLING LOAD CALCULATIONS

[S] 312.1 Load calculations. Heating and cooling system design loads for the purpose of sizing systems, *appliances* and *equipment* shall be determined in accordance with the procedures described in the ((~~ASHRAE/ACCA Standard 183~~)) *International Energy Conservation Code*. ((~~Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3 [CE] of the *International Energy Conservation Code*.~~))

CHAPTER 4

VENTILATION

User note:

About this chapter: *Chapter 4 intends to provide an indoor atmosphere that protects the health and well-being of building occupants. Both mechanical and natural ventilation are addressed. Mechanical ventilation provides what is considered to be acceptable indoor air quality. Mechanical ventilation minimizes adverse health effects and provides an atmosphere that generally is not objectionable to occupants.*

SECTION 401
GENERAL

401.1 Scope. This chapter shall govern the ventilation of spaces within a building intended to be occupied. Mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking *appliances*; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502 shall comply with Chapter 5.

[W][S] 401.2 Ventilation required. Every occupied space other than enclosed parking garages, loading docks and motor vehicle repair garages shall be ventilated by in accordance with Section 401.2.1, 401.2.2, or 401.2.3. Enclosed parking garages, loading docks and motor vehicle repair garages shall be ventilated by mechanical means in accordance with Sections 403 and 404.

401.2.1 Group R occupancies. Ventilation in Group R occupancies shall be provided in accordance with Section 403.4.

Note: The *Seattle Energy Code* requires that balanced ventilation be provided in Group R-2 dwelling and sleeping units.

401.2.2 Ambulatory care facilities and Group I-2 occupancies. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407.

401.2.3 All other occupancies. Ventilation in all other occupancies shall be provided natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ((~~*Dwelling units* complying with the air leakage requirements of the *International Energy Conservation Code* or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 *occupancies* shall be ventilated by mechanical means in accordance with Section 407.~~))

[W] 401.3 When required. Group R *occupancies* shall be vented continuously or intermittently in accordance with Section 403.4. Ventilation in all other *occupancies* shall be provided during the periods that the room or space is occupied.

[W][S] 401.4 Intake opening location. Air intake openings shall comply with all of the following:

1. Intake openings shall be located not less than 10 feet (3048 mm) from lot lines or buildings on the same lot. Where openings front on a street or public way, the distance shall be measured from the opposite side of the street or public way.
2. Mechanical and gravity outdoor air intake openings shall be located not less than 10 feet (3048 mm) horizontally from any hazardous or noxious contaminant source, such as vents, streets, alleys, parking lots and loading docks, except as specified in Item 3 or Section 501.3.1. Outdoor air intake openings shall be permitted to be located less than 10 feet (3048 mm) horizontally from streets, alleys, parking garage entries, parking lots and loading docks provided that the openings are located not less than 25 feet (7620 mm) vertically above such locations. Where openings front on a street or public way, the distance shall be measured from the closest edge of the street or public way.

   Exceptions:

   1. Intake air openings providing less than 500 cfm of outdoor air to Group R occupancies are permitted to be located less than 10 feet (3048 mm) horizontally from parking lots provided that the openings are not less than 15 feet (4572 mm) vertically above the parking lot.
   2. Intake air openings providing less than 500 cfm of outdoor air to Group R occupancies are permitted to be located less than 10 feet (3048 mm) horizontally from parking lots provided that the openings are not less than 15 feet (4572 mm) vertically above the clear height for vehicles in the parking garage.
   3. Enclosed parking garage and repair garage intakes are permitted to be located less than 10 feet horizontally of the street, alley, parking lots and loading docks.

3. Intake openings shall be located not less than 3 feet (914 mm) below contaminant sources where such sources are located within 10 feet (3048 mm) of the opening. Separation is not required between intake air openings and ((~~living space exhaust~~)) *environmental air* other than kitchen exhaust openings of an individual *dwelling unit* or *sleeping unit* where an approved factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacturer's instructions. For these combined terminations, the exhaust air concentration within the intake airflow shall not exceed 10 percent as established by the manufacturer, in accordance with ASHRAE 62.2 Section 6.8, exception 4.

Exceptions:

1. A minimum of 3 feet (914 mm) horizontal separation between other environmental air exhaust outlets and other dwelling or sleeping unit factory-built intake/exhaust combination termination fittings shall be maintained.
2. No separation is required between an energy recovery ventilation unit that provides exclusively whole house ventilation and serves only one *dwelling unit* or *sleeping unit*, and an operable opening of that same *dwelling unit* or *sleeping unit*.

4. Intake openings on structures in flood hazard areas shall be at or above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment.
5. Intake openings shall not be located:
   - 5.1. In a crawl space;
   - 5.2. Less than one foot (305 mm) above a roof, adjacent grade, or other surface directly below the intake; or
   - 5.3. Under a deck having a surface height less than three feet above grade or other surface directly below the intake.

Interpretation: For purposes of this section, lot line includes any property line separating one lot from another lot, but does not include any property line separating a lot from a public street or alley right-of-way.

401.5 Intake opening protection. Air intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in louvers, grilles and screens shall be sized in accordance with Table 401.5, and shall be protected against local weather conditions. Louvers that protect air intake openings in structures located in hurricane-prone regions, as defined in the *International Building Code*, shall comply with AMCA 550. Outdoor air intake openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code*.

TABLE 401.5
OPENING SIZES IN LOUVERS, GRILLES AND SCREENS PROTECTING AIR INTAKE OPENINGS

OUTDOOR OPENING TYPE	MINIMUM AND MAXIMUM OPENING SIZES IN LOUVERS, GRILLES AND SCREENS[a]
Intake openings in residential occupancies	Not < 1/4 inch and not > 1/2 inch
Intake openings in other than residential occupancies	> 1/4 inch and not > 1 inch

For SI: 1 inch = 25.4 mm.

a. For rectangular openings, the table requirements apply to the shortest side. For round openings, the table requirements apply to the diameter. For square openings, the table requirements apply to any side.

401.6 Contaminant sources. Stationary local sources producing airborne particulates, heat, odors, fumes, spray, vapors, smoke or gases in such quantities as to be irritating or injurious to health shall be provided with an exhaust system in accordance with Chapter 5 or a means of collection and removal of the contaminants. Such exhaust shall discharge directly to an *approved* location at the exterior of the building.

[W] 401.7 Testing and balancing. At the discretion of the building official, flow testing may be required to verify that the mechanical system(s) satisfies the requirements of this chapter. Flow testing may be performed using flow hood measuring at the intake or exhaust points of the system, in-line pitot tube, or pitot-traverse type measurement systems in the duct, short-term tracer gas measurements, or other means approved by the code official.

[W][S] 401.8 Compliance and commissioning. Compliance with Sections 402 through 403.4 shall be demonstrated through engineering calculations. Documentation of calculations shall be submitted with the permit plan sets. Testing and commissioning shall be performed and documented in accordance with the International Energy Conservation Code.

SECTION 402
NATURAL VENTILATION

[S][BG] 402.1 Natural ventilation. *Natural ventilation* of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

Exception: Automatically controlled *natural ventilation* systems do not require ready access and control by building occupants.

[BG] 402.2 Ventilation area required. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

[BG] 402.3 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining rooms shall be unobstructed and shall have an area not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that the openable area between the sunroom addition or patio cover and the interior room has an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

[BG] 402.4 Openings below grade. Where openings below grade provide required *natural ventilation*, the outdoor horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

SECTION 403
MECHANICAL VENTILATION

[W] 403.1 Ventilation system. Mechanical ventilation shall be provided by a method of supply air and return or *exhaust air*. ((~~except that mechanical ventilation air requirements for Group R-2, R-3 and R-4 *occupancies* shall be provided by an exhaust system, supply system or combination thereof.~~)) The amount of supply air shall be approximately equal to the amount of return and *exhaust air*. The system shall not be prohibited from producing negative or positive pressure. The system to convey *ventilation air* shall be designed and installed in accordance with Chapter 6.

[W][S] 403.2 Outdoor air required. The minimum outdoor ((~~airflow~~)) flow rate shall be determined in accordance with Section 403.3.

Exceptions:

1. Where the *registered design professional* demonstrates that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the minimum required rate of outdoor air shall be reduced in accordance with such engineered system design.
2. Alternate systems designed in accordance with ASHRAE Standard 62.1 Section 6.2, Ventilation Rate Procedure, shall be permitted.

[W] 403.2.1 Recirculation of air. The ((~~outdoor~~)) air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one *dwelling* to another or to dissimilar *occupancies*.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces where ((~~more than~~)) 10 percent or more of the resulting supply airstream consists of air recirculated from these spaces. The design and installation of dehumidification systems shall comply with ANSI/ACCA 10 Manual SPS.
3. Where mechanical exhaust is required by Note b in Table 403.3.1.1, recirculation of air from such spaces shall be prohibited. ((~~Recirculation of air that is contained completely within such spaces shall not be prohibited. Where recirculation of air is prohibited, all~~)) All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.1.1.

[W][S] 4. ((~~Where mechanical exhaust is required by Note g in Table 403.3.1.1, mechanical exhaust is required and recirculation from such spaces is prohibited where more than 10 percent of the resulting supply airstream consists of air recirculated from these spaces.~~)) Air used as transfer for heat removal may be circulated. Return air from such

spaces shall only be permitted to be recirculated when returned to an energy recovery ventilation system complying with Section 514. Recirculation of air that is contained completely within such spaces shall not be prohibited.

403.2.2 Transfer air. Except where recirculation from such spaces is prohibited by Table 403.3.1.1, air transferred from occupiable spaces is not prohibited from serving as *makeup air* for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and *exhaust air* shall be sufficient to provide the flow rates as specified in Section 403.3.1.1. The required outdoor airflow rates specified in Table 403.3.1.1 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

[W] 403.3 Outdoor air and local exhaust airflow rates. Group ((~~R-2, R-3 and R-4~~)) R occupancies ((~~three stories and less in height above grade plane~~)) shall be provided with outdoor air and local exhaust in accordance with Section ((~~403.3.2~~)) 403.4. ((~~Other~~)) All other buildings intended to be occupied shall be provided with outdoor air and local exhaust in accordance with Section 403.3.1.

403.3.1 Other buildings intended to be occupied. The design of local exhaust systems and ventilation systems for outdoor air for *occupancies* other than Group R-2, R-3 and R-4 three stories and less above grade plane shall comply with Sections 403.3.1.1 through 403.3.1.4.

[W] 403.3.1.1 Outdoor airflow rate. Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate, determined in accordance with this section. In each occupiable space, the ventilation system shall be designed to deliver the required rate of outdoor airflow to the *breathing zone*. Outdoor air shall be supplied directly to each occupiable space from an air handling unit through a fully ducted path or ducted to within 12 inches of the return air opening of a fan-powered terminal unit used to transfer the outdoor air to the occupiable space.

The occupant load utilized for design of the ventilation system shall be not less than the number determined from the estimated maximum occupant load rate indicated in Table 403.3.1.1. Ventilation rates for occupancies not represented in Table 403.3.1.1 shall be those for a listed *occupancy* classification that is most similar in terms of occupant density, activities and building construction; or shall be determined by an *approved* engineering analysis. The ventilation system, including transfer fan-powered terminal units, shall be designed to supply the required rate of *ventilation air* continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

With the exception of smoking lounges, the ventilation rates in Table 403.3.1.1 are based on the absence of smoking in occupiable spaces. Where smoking is anticipated in a space other than a smoking lounge, the ventilation system serving the space shall be designed to provide ventilation over and above that required by Table 403.3.1.1 in accordance with accepted engineering practice.

Exception: ((~~The occupant load is not required to be determined based on the estimated maximum occupant load rate indicated in Table 403.3.1.1 where *approved* statistical data document the accuracy of an alternative anticipated occupant density.~~)) Where *occupancy* density is known and documented in the plans, the outside air rate may be based on the design occupant density. Under no circumstance shall the *occupancies* used result in outside air less than one-half that resulting from application of Table 403.3.1.1 estimated maximum *occupancy* rates.

[W][S] TABLE 403.3.1.1
((~~MINIMUM VENTILATION RATES~~)) REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT^2 [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT^2 [a]	EXHAUST AIRFLOW RATE CFM/FT^2 [a]
Correctional facilities				
Booking/waiting	50	7.5	0.06	—
Cells				
without plumbing fixtures	25	5	0.12	—
[S] with plumbing fixtures[g, o]	25	5	0.12	1.0
Day room	30	5	0.06	—
Dining halls	—	—	—	—
(see "Food and beverage service")				
Guard stations	15	5	0.06	—
Dry cleaners, laundries				
Coin-operated dry cleaner	20	15	—	—
Coin-operated laundries	20	7.5	0.12	—
Commercial dry cleaner	30	30	—	—
Commercial laundry	10	5	0.12	—
Storage, pick up	30	7.5	0.12	—

[W][S] TABLE 403.3.1.1—continued
((~~MINIMUM VENTILATION RATES~~)) REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT² [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT² [a]	EXHAUST AIRFLOW RATE CFM/FT² [a]
Education				
Art classroom[g]	20	10	0.18	0.7
Auditoriums	150	5	0.06	—
Classrooms (ages 5–8)	25	10	0.12	—
Classrooms (age 9 plus)	35	10	0.12	—
Computer lab	25	10	0.12	—
Corridors (see "Public spaces")	—	—	—	—
Day care (through age 4)	25	10	0.18	—
Lecture classroom	65	7.5	0.06	—
Lecture hall (fixed seats)	150	7.5	0.06	—
[S] Locker/dressing rooms[g, o]	—	—	—	0.25
Media center	25	10	0.12	—
Multiuse assembly	100	7.5	0.06	—
Music/theater/dance	35	10	0.06	—
[S] Science laboratories[g, o]	25	10	0.18	1.0
[S] ((~~Smoking lounges~~[b]	~~70~~	~~60~~	~~—~~	~~—~~))
Sports locker rooms[g, o]	—	—	—	0.5
Wood/metal shops[g, o]	20	10	0.18	0.5
Food and beverage service				
Bars, cocktail lounges	100	7.5	0.18	—
Cafeteria, fast food	100	7.5	0.18	—
Dining rooms	70	7.5	0.18	—
Kitchens (cooking)[b]	20	7.5	0.12	0.7
Hotels, motels, resorts and dormitories				
[S] Bathrooms/toilet—private[g, o]	—	—	—	25/50[f]
Bedroom/living room	10	5	0.06	—
Conference/meeting	50	5	0.06	—
Dormitory sleeping areas	20	5	0.06	—
Gambling casinos	120	7.5	0.18	—
Lobbies/prefunction	30	7.5	0.06	—
Multipurpose assembly	120	5	0.06	—
Offices				
Conference rooms	50	5	0.06	—
[W] Kitchenettes[k]	25	5	0.06	0.30
Main entry lobbies	10	5	0.06	—
Office spaces	5	5	0.06	—
Reception areas	30	5	0.06	—
Telephone/data entry	60	5	0.06	—
Private dwellings, single and multiple				
Garages, common for multiple units[b]	—	—	—	0.75
[W] Kitchens[b]	—	—	—	((~~50/100~~[f])) See Table 403.4.7
[W] Living areas[c]	Based on number of bedrooms. First bedroom, 2; each additional bedroom, 1	((~~0.35 ACH but not less than 15 cfm/person~~)) See Table 403.4.2	—	—
[W] Toilet rooms, and bathrooms[g, o]	—	—	—	((~~25/50~~[f])) See Table 403.4.7

[W][S] TABLE 403.3.1.1—continued
((~~MINIMUM VENTILATION RATES~~)) REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT² [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT² [a]	EXHAUST AIRFLOW RATE CFM/FT² [a]
Public spaces				
[W] Corridors serving other than Group R occupancies	—	—	0.06	—
[W] Corridors serving Group R dwelling or sleeping units with whole house exhaust system	—	—	0.12	—
[W] Corridors serving Group R dwelling or sleeping units with other than whole house exhaust system	—	—	0.06	—
Courtrooms	70	5	0.06	—
Elevator car	—	—	—	1.0
[W][S] Elevator lobbies in parking garages[n]	—	—	1.0[o]	—
Legislative chambers	50	5	0.06	—
Libraries	10	5	0.12	—
Museums (children's)	40	7.5	0.12	—
Museums/galleries	40	7.5	0.06	—
Places of religious worship	120	5	0.06	—
Shower room (per shower head)[g]	—	—	—	50/20[f]
[S] ((~~Smoking lounges~~[b]	~~70~~	~~60~~	—	—))
Toilet rooms — public[g]	—	—	—	50/70[e]
Retail stores, sales floors and showroom floors				
Dressing rooms	—	—	—	0.25
Mall common areas	40	7.5	0.06	—
Sales	15	7.5	0.12	—
Shipping and receiving	2	10	0.12	—
[S] ((~~Smoking lounges~~[b]	~~70~~	~~60~~	—	—))
Storage rooms	—	—	0.12	—
Warehouses (see "Storage")	—	10	0.06	—
Specialty shops				
Automotive motor fuel-dispensing stations[b]	—	—	—	1.5
[S] Barber	25	((~~7.5~~)) 20	0.06	0.5
Beauty salons[b]	25	20	0.12	0.6
Embalming room[b]	—	—	—	2.0
Nail salons[b, h]	25	20	0.12	0.6
Pet shops (animal areas)[b]	10	7.5	0.18	0.9
Supermarkets	8	7.5	0.06	—
Sports and amusement				
Bowling alleys (seating areas)	40	10	0.12	—
Disco/dance floors	100	20	0.06	—
Game arcades	20	7.5	0.18	—
[W] Gym, stadium, arena (play area)[i]	((~~7~~)) —	((~~20~~)) —	((~~0.18~~)) 0.30	—
Health club/aerobics room	40	20	0.06	—
Health club/weight room	10	20	0.06	—
Ice arenas without combustion engines[i]	—	—	0.30	0.5
Spectator areas	150	7.5	0.06	—
Swimming pools (pool and deck area)	—	—	0.48	—

[W][S] TABLE 403.3.1.1—continued
((~~MINIMUM VENTILATION RATES~~)) REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT² [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT² [a]	EXHAUST AIRFLOW RATE CFM/FT² [a]
Storage				
[W] Janitor closets, trash rooms, recycling rooms	—	—	—	1.0
[S] Refrigerated warehouses/freezers[m]	—	10	—	0.75
[W] Repair garages[d] ((~~, enclosed parking garages~~[b, d]))	—	—	—	0.75
[S] Enclosed loading docks[d]	—	—	—	1.5
[S] Enclosed parking garages[d]	—	—	—	0.75
[S] Ticket booths (within enclosed parking garages)[l]	60	—	—	—
[W] Storage rooms, chemical	—	—	—	1.5
Warehouses	—	10	0.06	—
[S] Non-retail storage spaces >100 sf[o]	—	—	0.06	—
Theaters				
Auditoriums (see "Education")	—	—	—	—
Lobbies	150	5	0.06	—
Stages, studios	70	10	0.06	—
Ticket booths	60	5	0.06	—
Transportation				
Platforms	100	7.5	0.06	—
Transportation waiting	100	7.5	0.06	—
Workrooms				
Bank vaults/safe deposit	5	5	0.06	—
Computer (without printing)	4	5	0.06	—
Copy, printing rooms	4	5	0.06	0.5
Darkrooms	—	—	—	1.0
[W] Freezer and refrigerated spaces (<50°F)[m]	0	10	0	0
Meat processing[c]	10	15	—	—
Pharmacy (prep. area)	10	5	0.18	—
Photo studios	10	5	0.12	—

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$, °C = [(°F) – 32]/1.8, 1 square foot = 0.0929 m^2.

a. Based upon net occupiable floor area.

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).

c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems ((~~in enclosed parking garages~~)) shall comply with Section 404.

e. Rates are per water closet or urinal. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

[W][S] g. Mechanical exhaust is required and recirculation from such spaces is prohibited. For occupancies other than science laboratories, where there is a wheel-type energy recovery ventilation (ERV) unit in the exhaust system design, the volume of air leaked from the exhaust airstream into the outdoor airstream within the ERV shall be less than 10 percent of the outdoor air volume. ((~~Recirculation~~)) Reconditioning of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Items 2 and 4).

h. For nail salons, each manicure and pedicure station shall be provided with a source capture system capable of exhausting not less than 50 cfm per station. Exhaust inlets shall be located in accordance with Section 502.20. Where one or more required source capture systems operate continuously during occupancy, the exhaust rate from such systems shall be permitted to be applied to the exhaust flow rate required by Table 403.3.1.1 for the nail salon.

[W] i. Reserved.

[W] j. When combustion equipment is intended to be used on the playing surface, additional dilution ventilation and/or source control shall be provided.

[W] k. Kitchenettes require exhaust when they contain a domestic cooking appliance range or oven that is installed in accordance with Table 507.1.2. Kitchenettes that only contain a microwave cooking appliance are not required to have exhaust. A kitchenette may not contain commercial cooking appliances that require Type I or Type II exhaust as these occupancies are required to be exhausted to the kitchen category in Table 403.3.1.1.

[S] l. This space shall be maintained at a positive pressure.

[S] m. For occupied freezer and refrigerated spaces utilize proposed occupant density for outdoor airflow rates.

[S] n. The required outdoor airflow rate shall be introduced directly into such spaces or into the occupied space from which the air is transferred or a combination of both.

[S] o. Transfer air permitted in accordance with Section 403.2.2. For non-retail storage areas, transfer air is also permitted from an adjacent open parking garage, or an enclosed parking garage or loading dock that is mechanically ventilated in accordance with Section 404.

403.3.1.1.1 Zone outdoor airflow. The minimum outdoor airflow required to be supplied to each zone shall be determined as a function of *occupancy* classification and space air distribution effectiveness in accordance with Sections 403.3.1.1.1.1 through 403.3.1.1.1.3.

403.3.1.1.1.1 Breathing zone outdoor airflow. The outdoor airflow rate required in the *breathing zone* (V_{bz}) of the *occupiable space* or spaces in a zone shall be determined in accordance with Equation 4-1.

$$V_{bz} = R_p P_z + R_a A_z \quad \textbf{(Equation 4-1)}$$

where:

A_z = Zone floor area: the net *occupiable floor area* of the space or spaces in the zone.
P_z = Zone population: the number of people in the space or spaces in the zone.
R_p = People outdoor air rate: the outdoor airflow rate required per person from Table 403.3.1.1.
R_a = Area outdoor air rate: the outdoor airflow rate required per unit area from Table 403.3.1.1.

403.3.1.1.1.2 Zone air distribution effectiveness. The zone air distribution effectiveness (E_z) shall be determined using Table 403.3.1.1.1.2.

TABLE 403.3.1.1.1.2
ZONE AIR DISTRIBUTION EFFECTIVENESS[a, b, c, d]

AIR DISTRIBUTION CONFIGURATION	E_z
Ceiling or floor supply of cool air	1.0[e]
Ceiling or floor supply of warm air and floor return	1.0
Ceiling supply of warm air and ceiling return	0.8[f]
Floor supply of warm air and ceiling return	0.7
Makeup air drawn in on the opposite side of the room from the exhaust or return	0.8
Makeup air drawn in near to the exhaust or return location	0.5

For SI: 1 foot = 304.8 mm, 1 foot per minute = 0.00506 m/s, °C = [(°F) – 32]/1.8.

a. "Cool air" is air cooler than space temperature.
b. "Warm air" is air warmer than space temperature.
c. "Ceiling" includes any point above the breathing zone.
d. "Floor" includes any point below the breathing zone.
e. Zone air distribution effectiveness of 1.2 shall be permitted for systems with a floor supply of cool air and ceiling return, provided that low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.
f. Zone air distribution effectiveness of 1.0 shall be permitted for systems with a ceiling supply of warm air, provided that supply air temperature is less than 15°F above space temperature and provided that the 150-foot-per-minute supply air jet reaches to within 4-1/2 feet of floor level.

403.3.1.1.1.3 Zone outdoor airflow. The zone outdoor airflow rate (V_{oz}), shall be determined in accordance with Equation 4-2.

$$V_{oz} = \frac{V_{bz}}{E_z} \quad \textbf{(Equation 4-2)}$$

403.3.1.1.2 System outdoor airflow. The outdoor air required to be supplied by each ventilation system shall be determined in accordance with Sections 403.3.1.1.2.1 through 403.3.1.1.2.3.4 as a function of system type and zone outdoor airflow rates.

403.3.1.1.2.1 Single zone systems. Where one air handler supplies a mixture of outdoor air and recirculated return air to only one zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Equation 4-3.

$$V_{ot} = V_{oz} \quad \textbf{(Equation 4-3)}$$

403.3.1.1.2.2 100-percent outdoor air systems. Where one air handler supplies only outdoor air to one or more zones, the system outdoor air intake flow rate (V_{ot}) shall be determined using Equation 4-4.

$V_{ot} = \Sigma_{all\ zones} V_{oz}$ **(Equation 4-4)**

[W] 403.3.1.1.2.3 Multiple zone recirculating systems. ((~~Where~~)) For ventilation systems wherein one or more air handlers ((~~supplies~~)) supply a mixture of outdoor air and recirculated ((~~return~~)) air to more than one ventilation zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Sections 403.3.1.1.2.3.1 through 403.3.1.1.2.3.4.

403.3.1.1.2.3.1 ((~~Primary outdoor air fraction~~)) Uncorrected outdoor air intake. ((~~The primary outdoor air fraction (Z_p) shall be determined for each zone in accordance with Equation 4-5.~~

~~$Z_p = \frac{V_{oz}}{V_{pz}}$~~ **(Equation 4-5)**

~~where:~~

~~V_{pz} = Primary airflow: The airflow rate supplied to the zone from the airhandling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means. For design purposes, V_{pz} shall be the zone design primary airflow rate, except for zones with variable air volume supply and V_{pz} shall be the lowest expected primary airflow rate to the zone when it is fully occupied.~~))

The uncorrected outdoor air intake flow (V_{ou}) shall be determined in accordance with Equation 4-5.

$V_{ou} = D\Sigma_{all\ zones}(R_p \times P_z) + \Sigma_{all\ zones}(R_a \times A_z)$ **(Equation 4-5)**

403.3.1.1.2.3.1.1 Occupant diversity. The occupant diversity ratio (D) shall be determined in accordance with Equation 4-6 to account for variations in population within the ventilation zones served by the system.

$D = P_s/\Sigma_{all\ zones} P_z$ **(Equation 4-6)**

where: P_s = System population: The total population in the area served by the system.

Exception: Alternative methods to account for occupant diversity shall be permitted, provided the resulting V_{ou} value is no less than that determined using Equation 4-5.

403.3.1.1.2.3.1.2 Design system population. Design system population (P_s) shall equal the largest (peak) number of people expected to occupy all ventilation zones served by the ventilation system during use.

Note: Design system population is always equal to or less than the sum of design zone population for all zones in the area served by the system because all zones may or may not be simultaneously occupied at design population.

[W] 403.3.1.1.2.3.2 System ventilation efficiency. The system ventilation efficiency (E_v) shall be determined ((~~using Table 403.3.1.1.2.3.2~~)) in accordance with Section 403.3.1.1.2.3.3 or Appendix A of ASHRAE 62.1 for the Alternative Procedure.

Note: These procedures also establish zone minimum primary air-flow rates for VAV systems.

TABLE 403.3.1.1.2.3.2
SYSTEM VENTILATION EFFICIENCY[a, b]

Max (Z_p)	E_v
≤ 0.15	1
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
≤ 0.65	0.5
≤ 0.75	0.4
> 0.75	0.3

a. *Max (Z_p)* is the largest value of Z_p calculated using Equation 4-5 among all the zones served by the system.
b. Interpolating between table values shall be permitted.

[W] 403.3.1.1.2.3.3 ((~~Uncorrected outdoor air intake~~)) Simplified procedure. ((~~The uncorrected outdoor air intake flow rate (V_{ou}) shall be determined in accordance with Equation 4-6.~~

~~$V_{ou} = D\Sigma_{all\ zones} R_p P_z + \Sigma_{all\ zones} R_a A_z$~~ **~~(Equation 4-6)~~**

~~where:~~

~~D = Occupant diversity: the ratio of the system population to the sum of the zone populations, determined in accordance with Equation 4-7.~~

~~$D = \frac{P_s}{\Sigma_{all\ zones} P_z}$~~ **~~(Equation 4-7)~~**

~~where:~~

~~P_s = System population: The total number of occupants in the area served by the system. For design purposes, P_s shall be the maximum number of occupants expected to be concurrently in all zones served by the system.~~))

403.3.1.1.2.3.3.1 System ventilation efficiency. System ventilation efficiency (E_v) shall be determined in accordance with Equation 4-6a or 4-6b.

$E_v = 0.88 \times D + 0.22$ for $D < 0.60$ **(Equation 4-6a)**

$E_v = 0.75$ for $D \geq 0.60$ **(Equation 4-6b)**

403.3.1.1.2.3.3.2 Zone minimum primary airflow. For each zone, the minimum primary airflow (V_{pz}-*min*) shall be determined in accordance with Equation 4-7.

V_{pz}-*min* $= V_{oz} \times 1.5$ **(Equation 4-7)**

[W] 403.3.1.1.2.3.4 Outdoor air intake flow rate. The design outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Equation 4-8.

$$V_{ot} = \frac{V_{ou}}{E_v}$$ **(Equation 4-8)**

403.3.1.2 Exhaust ventilation. Exhaust airflow rate shall be provided in accordance with the requirements of Table 403.3.1.1. Outdoor air introduced into a space by an exhaust system shall be considered as contributing to the outdoor airflow required by Table 403.3.1.1.

[S] 403.3.1.3 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3.1.1 and the actual number of occupants present. Where demand-controlled ventilation is employed to adjust the outdoor airflow rate based on the actual number of occupants present, the minimum quantity of outdoor air shall not fall below that determined from the area outdoor airflow rate column of Table 403.3.1.1 during periods when the building is expected to be occupied. For zones in the occupied standby mode, breathing zone outdoor airflow shall be permitted to be reduced to zero for the occupancy categories indicated "OS" in Table 6-1 of ASHRAE 62.1, provided that airflow is restored to V_{bz} whenever occupancy is detected.

[S] 403.3.1.4 Variable air volume system control. Variable air volume air distribution systems, other than those designed to supply only 100-percent outdoor air, shall be provided with controls to regulate the flow of outdoor air. Such control system shall be designed to maintain the flow rate of outdoor air at a rate of not less than that required by Section 403.3 over the entire range of supply air operating rates. Calculations and a description of controls operation shall be submitted with the permit drawings.

[W] 403.3.2 Group R-2, R-3 and R-4 occupancies, three stories and less. ((~~The design of local exhaust systems and ventilation systems for outdoor air in Group R-2, R-3 and R-4 *occupancies* three stories and less in height above grade plane shall comply with Sections 403.3.2.1 through 403.3.2.5.~~)) Sections 403.3.2 through 403.3.2.5 are not adopted; see Section 403.4.

((~~**403.3.2.1 Outdoor air for dwelling units.** An outdoor air ventilation system consisting of a mechanical exhaust system, supply system or combination thereof shall be installed for each *dwelling unit*. Local exhaust or supply systems, including outdoor air ducts connected to the return side of an air handler, are permitted to serve as such a system. The outdoor air ventilation system shall be designed to provide the required rate of outdoor air continuously during the period that the building is occupied. The minimum continuous outdoor airflow rate shall be determined in accordance with Equation 4-9.~~

~~$Q_{OA} = 0.01A_{floor} + 7.5(N_{br} + 1)$~~ **~~(Equation 4-9)~~**

where:

Q_{OA} = outdoor airflow rate, cfm

A_{floor} = floor area, ft^2

N_{br} = number of bedrooms; not to be less than one

Exceptions:

1. The outdoor air ventilation system is not required to operate continuously where the system has controls that enable operation for not less than 1 hour of each 4-hour period. The average outdoor airflow rate over the 4-hour period shall be not less than that prescribed by Equation 4-9.
2. The minimum mechanical ventilation rate determined in accordance with Equation 4-9 shall be reduced by 30 percent provided that both of the following conditions apply:
   2.1. A ducted system supplies ventilation air directly to each bedroom and to one or more of the following rooms:
      2.1.1. Living room.
      2.1.2. Dining room.
      2.1.3. Kitchen.
   2.2. The whole-house ventilation system is a *balanced ventilation* system.

403.3.2.2 Outdoor air for other spaces. Corridors and other common areas within the conditioned space shall be provided with outdoor air at a rate of not less than 0.06 cfm per square foot [$0.0003\ m^3/(s \cdot m^2)$] of floor area.

403.3.2.3 Local exhaust. Local exhaust systems shall be provided in kitchens, bathrooms and toilet rooms and shall have the capacity to exhaust the minimum airflow rate determined in accordance with Table 403.3.2.3.))

((TABLE 403.3.2.3
MINIMUM REQUIRED LOCAL EXHAUST RATES FOR GROUP R-2, R-3 AND R-4 OCCUPANCIES

AREA TO BE EXHAUSTED	EXHAUST RATE CAPACITY
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms and toilet rooms	50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = $0.0004719\ m^3/s$.))

((**403.3.2.4 System controls.** Where provided within a *dwelling unit*, controls for outdoor air ventilation systems shall include text or a symbol indicating the system's function.

403.3.2.5 Ventilating equipment. Fans providing exhaust or outdoor air shall be *listed* and *labeled* to provide the minimum required air flow in accordance with ANSI/AMCA 210 ANSI/ASHRAE 51.))

[W] 403.4 Group R whole house mechanical ventilation system. Each dwelling unit or sleeping unit shall be equipped with a whole house mechanical ventilation system that complies with Sections 403.4.1 through 403.4.6.

Each dwelling unit or sleeping unit shall be equipped with local exhaust complying with Section 403.4.7. All occupied spaces, including public corridors, other than the Group R dwelling units and/or sleeping units, that support these Group R occupancies shall meet the ventilation requirement of natural ventilation requirements of Section 402 or the mechanical ventilation requirements of Sections 403.1 through 403.3.

Exception: Alternate *balanced whole house ventilation* systems and local exhaust systems subject to the Washington State Energy Code, Residential Building Provisions serving Group R dwelling units designed and commissioned in accordance with ASHRAE Standard 62.2 are permitted.

[W] 403.4.1 System design. The whole house ventilation system shall consist of one or more supply fans, one or more exhaust fans, or an ERV/HRV with integral fans; and the associated ducts and controls. Local exhaust fans shall be permitted to serve as part of the whole house ventilation system when provided with the proper controls in accordance with Section 403.4.5. The systems shall be designed and installed to supply and exhaust the minimum outdoor airflow rates in accordance with Section 403.4.2 as corrected by the balanced and/or *distributed whole house ventilation* system coefficients in accordance with Section 403.4.3 where applicable.

[W] 403.4.2 Whole house mechanical ventilation rates. The sleeping unit whole house mechanical ventilation minimum outdoor airflow rate shall be determined in accordance with the breathing zone ventilation rates minimum outdoor airflow rate shall be determined in accordance with the breathing zone ventilation rates requirements of Section 403.3.1.1.1.2 using Equation 4-2. The dwelling unit whole house mechanical ventilation minimum outdoor airflow rate shall be determined in accordance with Equation 4-10 or Table 403.4.2.

[W] TABLE 403.4.2
WHOLE HOUSE MECHANICAL VENTILATION AIRFLOW RATE
(CONTINUOUSLY OPERATING SYSTEMS)

FLOOR AREA (ft^2)	BEDROOMS[a]				
	1	2	3	4	5
< 500	30	30	35	45	50
500 – 1000	30	35	40	50	55
1001 – 1500	30	40	45	55	60
1501 – 2000	35	45	50	60	65
2001 – 2500	40	50	55	65	70
2501 – 3000	45	55	60	70	75
3001 – 3500	50	60	65	75	80
3501 – 4000	55	65	70	80	85
4001 – 4500	60	70	75	85	90
4501 – 5000	65	75	80	90	95

a. Minimum airflow (Q_r) is set at not less than 30 cfm for each dwelling unit.

$$Q_r = 0.01 \times A_{floor} + 7.5 \times (N_{br} + 1) \quad \textbf{(Equation 4-10)}$$

where:

Q_r = Ventilation airflow rate, cubic feet per minute (cfm) but not less than 30 cfm for each dwelling unit.
A_{floor} = Conditioned floor area, square feet (ft^2)
N_{br} = Number of bedrooms, not less than one.

[W] 403.4.3 Ventilation quality adjustment. The minimum whole house ventilation rate from Section 403.4.2 shall be adjusted by the system coefficient in Table 403.4.3 based on the system type not meeting the definition of a *balanced whole house ventilation* system and/or not meeting the definition of a *distributed whole house ventilation* system.

[W] TABLE 403.4.3
SYSTEM COEFFICIENT (C_{system})

SYSTEM TYPE	DISTRIBUTED	NOT DISTRIBUTED
Balanced	1.0	1.25
Not Balanced	1.25	1.5

$$Q_v = Q_r \times C_{system} \quad \textbf{(Equation 4-11)}$$

where:

Q_v = Quality-adjusted ventilation airflow rate in cubic feet per minute (cfm)
Q_r = Ventilation airflow rate, cubic feet per minute (cfm) from Equation 4-10 or Table 403.4.2
C_{system} = System coefficient from Table 403.4.2

Interpretation: Per the definition of *distributed whole house ventilation* system and per Section 403.4.4.1 and 403.4.4.2 the whole house supply fan shall provide ducted outdoor ventilation to each habitable space within the residential unit. The intent is that whole house ventilation systems are only allowed to have exhaust that is "Not Distributed." Therefore, the "Not Distributed" system coefficients in Table 403.4.3 are only applied to the residential unit whole house ventilation airflows when intermittent local exhaust that is not part of the unit whole house ventilation system is provided in one or more of the bathrooms or kitchen of the residential unit.

[W] 403.4.4 Whole house ventilation residential occupancies. Residential dwelling and sleeping unit whole house ventilation systems shall meet the requirements of Sections 403.4.4.1 or 403.4.4.2 depending on the occupancy of the residential unit.

[W] 403.4.4.1 Whole house ventilation in Group R-2 occupancies. Residential dwelling and sleeping units in Group R-2 occupancies system shall include supply and exhaust fans and be a *balanced whole house ventilation* system in accordance with Section 403.4.6.3. The system shall include a heat or energy recovery ventilator with a sensible heat recovery effectiveness as prescribed in Section C403.3.6 or when selected as an option of R406 of the *Seattle Energy Code*. The whole house ventilation system shall operate continuously at the minimum ventilation rate determined in accordance with Section 403.4. The whole house supply fan shall provide ducted outdoor ventilation air to each habitable space within the residential unit.

Exceptions:

1. *Interior adjoining spaces* that are ventilated from another habitable space are not required to have outdoor air ducted directly to the adjoining space. These systems are considered *not distributed whole house ventilation systems* and shall use the "not distributed" quality adjustment system coefficient in accordance with Section 403.4.3.
2. *Interior adjacent rooms* that are ventilated from another habitable space are not required to have outdoor air ducted directly to the *interior adjacent room*. These systems are considered *not distributed whole house ventilation systems* and shall use the "not distributed" quality adjustment system coefficient in accordance with Section 403.4.3. The *interior adjacent room* shall be provided with a transfer fan with a minimum airflow rate of 30 cfm or with relief air inlet with a minimum airflow of 20 cfm that is connected to the exhaust/relief air inlet of an ERV/HRV whole house ventilation system. Transfer fans that ventilate *interior adjacent rooms* shall meet the sone rating in Section 403.4.6 and shall have whole house ventilation controls in accordance with Section 403.4.5.

[W] 403.4.4.2 Whole house ventilation for other than Group R-2 occupancies. Residential dwelling and sleeping units in other than Group R-2 occupancies, including I-1 condition 2 occupancies, shall have a whole house mechanical ventilation system with supply and exhaust fans in accordance with Section 403.4.6.1, 403.4.6.2, 403.4.6.3, or 403.4.6.4. The whole house ventilation system shall operate continuously at the minimum ventilation rate determined in accordance with Section 403.4.2 unless configured with intermittent off controls in accordance with Section 403.4.6.5. The whole house supply fan shall provide ducted outdoor ventilation air to each habitable space within the residential unit.

Exceptions:

1. *Interior adjoining spaces* that are ventilated from another habitable space are not required to have outdoor air ducted directly to the adjoining space. These systems are considered *not distributed whole house ventilation systems* and shall use the "not distributed" quality adjustment system coefficient in accordance with Section 403.4.3.
2. *Interior adjacent rooms* that are ventilated from another habitable space are not required to have outdoor air ducted directly to the *interior adjacent room*. These systems are considered *not distributed whole house ventilation systems* and shall use the "not distributed" quality adjustment system coefficient in accordance with Section 403.4.3. The *interior adjacent room* shall be provided with a transfer fan with a minimum airflow rate of 30 cfm or with relief air inlet with a minimum airflow of 20 cfm that is connected to the exhaust/relief air inlet of an ERV/HRV whole house ventilation system. Transfer fans that ventilate *interior adjacent rooms* shall meet the sone rating in Section 403.4.6 and shall have whole house ventilation controls in accordance with Section 403.4.5.

[W][S] 403.4.5 Whole house ventilation system controls.

1. The whole house ventilation system shall be controlled and the controls shall be readily accessible by the occupant with one or more of the following:
   1.1. Manual switches;
   1.2. Timers;
   1.3. Other means that provide for automatic operation of the ventilation system.
2. Whole house mechanical ventilation system shall be provided with controls that enable manual override off of the system by the occupant during periods of poor outdoor air quality. Controls hall include permanent text or a symbol indicating their function. Recommended control permanent labeling to include text similar to the following "Leave on unless outdoor air quality s very poor." Manual controls shall be provided with ready access for the occupant.

   Exception: Central whole house mechanical systems with supply air and/or exhaust that serve more than one dwelling or sleep units are not required to have manual override off controls accessible to the occupant.
3. Whole house ventilation systems shall be configured to operate continuously except where intermittent off controls are provided in accordance with Section 403.4.6.5 and allowed by Section 403.4.4.2.

[W] 403.4.6 Whole house ventilation system component requirements. Whole house ventilation supply and exhaust fans specified in this section shall have a minimum efficacy as prescribed in the *Washington State Energy Code*. The fans shall be rated for sound at a maximum of 1.0 sone at design airflow and static pressure conditions. Design and installation of the system or equipment shall be carried out in accordance with manufacturer's installation instructions.

Exceptions:

1. Central supply or exhaust fans serving multiple residential units do not need to comply with the maximum fan sone requirements.

2. Interior joining spaces provided with a 30 cfm transfer fan or a 25-square-foot permanent opening do not require supply ventilation air directly to the space. Transfer fans shall meet the sone rating above and have whole house ventilation controls in accordance with Section 403.4.5.

[W] 403.4.6.1 Exhaust fans. Exhaust fans required shall be ducted directly to the outside in accordance with Section 501.3. Exhaust air outlets shall be designed to limit the pressure difference to the outside to limiting the outlet free area maximum velocity to 500 feet per minute and equipped with backdraft dampers or motorized dampers in accordance with *Washington State Energy Code*. Exhaust fans shall be tested and rated in accordance with HVI 915, HVI 916, and HVI 920. Exhaust fans required in this section may be used to provide local ventilation. Exhaust fans serving spaces other than kitchens that are designed for intermittent exhaust airflow rates in Table 403.4.7 shall be provided with occupancy sensors or humidity sensors, timer controls, or pollutant sensor controls to automatically override the fan to the high speed airflow rate. The exhaust fans shall be tested and the testing results shall be submitted and posted in accordance with Section 403.4.6.7.

Exceptions:

1. Central exhaust fans serving multiple residential units do not need to comply with the HVI testing requirements.
2. Inlet free area maximum velocity may exceed 500 feet per minute when a factory-built combined exhaust/intake termination fitting is used.

403.4.6.2 Supply fans. Supply fans used in meeting the requirements of this section shall supply outdoor air from intake openings in accordance with Sections 401.4 and 401.5. Intake air openings shall be designed to limit the pressure difference to the outside to limiting the inlet free area maximum velocity to 500 feet per minute and when designed for intermittent off operation shall be equipped with motorized dampers in accordance with the Washington State Energy Code. Supply fans shall be tested and rated in accordance with HVI 915, HVI 916, and HVI 920. Where outdoor air is provided to each habitable dwelling unit or sleeping unit by supply fan systems the outdoor air shall be filtered. The filter shall be provided with access for regular maintenance and replacement. The filter shall have a Minimum Efficiency Rating Value (MERV) of at least 8.

Exception: Central supply fans serving multiple residential units do not need to comply with the HVI testing requirements.

403.4.6.3 Balanced whole house ventilation system. A *balanced whole house ventilation* system shall include both supply and exhaust fans. The supply and exhaust fans shall have airflow that is within 10 percent of each other. The tested and balanced total mechanical exhaust airflow rate is within 10 percent or 5 cfm, whichever is greater, of the total mechanical supply airflow rate. The flow rate test results shall be submitted and posted in accordance with Section 403.4.6.6. The exhaust fan shall meet the requirements of Section 403.4.6.1. The supply fan shall meet the requirements of Section 403.4.6.2. For R-2 dwelling and sleeping units, the system is required to have *balanced whole house ventilation* but is not required to have *distributed whole house ventilation* where the not distributed system coefficient from Table 403.4.2 is utilized to correct the whole house mechanical ventilation rate. The system shall be designed and balanced to meet the pressure equalization requirements of Section 501.4. Local exhaust systems that are not a component of the whole-house mechanical ventilation system are exempt from the balanced airflow calculation.

403.4.6.4 Furnace integrated supply. Systems using space condition heating and/or cooling air handler fans for outdoor air supply air distribution are not permitted.

Exception: Air handler fans shall be permitted that have multi-speed or variable speed supply airflow control capability with a low speed operation not greater than 25 percent of the rated supply air flow capacity during ventilation only operation. Outdoor air intake openings must meet the provisions of Sections 401.4 and 401.5 and must include a motorized damper that is activated by the whole house ventilation system controller. Intake air openings shall be designed to limit the pressure difference to the outside to limiting the inlet free area maximum velocity to 500 feet per minute. The motorized damper must be controlled to maintain the outdoor airflow intake airflow within 10 percent of the whole house mechanical exhaust airflow rate. The supply air handler shall provide supply air to each habitable space in the residential unit. The whole house ventilation system shall include exhaust fans in accordance with Section 403.4.6.1 to meet the pressure equalization requirements of Section 501.4. The flow rate for the outdoor air intake must be tested and verified at the minimum ventilation fan speed and the maximum heating or cooling fan speed. The results of the test shall be submitted and posted in accordance with Section 403.4.6.6.

403.4.6.5 Intermittent off operation. Whole house mechanical ventilation systems shall be provided with advanced controls that are configured to operate the system with intermittent off operation and shall operate for a least two hours in each four-hour segment. The whole house ventilation airflow rate determined in accordance with Section 403.4.2 as corrected by Section 403.4.3 shall be multiplied by the factor determined in accordance with Table 403.4.6.5.

[W] TABLE 403.4.6.5
INTERMITTENT WHOLE HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	50%	66%	75%	100%
Factor[a]	2	1.5	1.3	1.0

a. For ventilation system run-time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

403.4.6.6 Testing. Whole house mechanical ventilation systems shall be tested, balanced and verified to provide a flow rate not less than the minimum required by Sections 403.4.2 and 403.4.3. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals, outlet terminals or grilles or in the connected ventilation ducts. Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official and shall be posted in the residential unit in accordance with Section 403.4.6.7.

403.4.6.7 Certificate. A permanent certificate shall be completed by the mechanical contractor, test and balance contractor or other approved party and posted on a wall in the space where the furnace is located, a utility room, or an *approved* location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall list the flow rate determined from the delivered airflow of the whole house mechanical ventilation system as installed and the type of mechanical whole house ventilation system used to comply with Section 403.4.3.

[W] 403.4.7 Local exhaust. Bathrooms, toilet rooms and kitchens shall include a local exhaust system. Such local exhaust systems shall have the capacity to exhaust the minimum airflow rate in accordance with Table 403.4.7 and Table 403.3.1.1, including notes. Fans required by this section shall be provided with controls that enable manual override or automatic occupancy sensor, humidity sensor, timer controls, or pollutant sensor controls. An "on/off" switch shall meet this requirement for manual controls. Manual fan controls shall be provided with ready access in the room served by the fan.

[W] TABLE 403.4.7
MINIMUM EXHAUST RATES

AREA TO BE EXHAUSTED	EXHAUST RATE	
	INTERMITTENT	CONTINUOUS
Open kitchens	In accordance with Section 403.4.7.3	Not permitted
Enclosed kitchens	In accordance with Section 403.4.7.3	5 ACH based on kitchen volume
Bathrooms–Toilet rooms	50 cfm	20 cfm

[W][S] 403.4.7.1 Combined local exhaust and whole house ventilation controls. If the local exhaust fan is included in a whole house ventilation system in accordance with Section 403.4.6, the exhaust fan shall be controlled to operate as specified in Section 403.4.5.

[W] 403.4.7.2 Local exhaust fans. Exhaust fans shall meet the following criteria:

1. Exhaust fans shall be tested and rated in accordance with HVI 915, HVI 916, and HVI 920 or equivalent.
2. Fan airflow rating and duct system shall be designed and installed to deliver at least the exhaust airflow required by Table 403.4.7. The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device. Local exhaust systems shall be tested, balanced and verified to provide a flow rate not less than the minimum required by this section.

   Exceptions:

   1. An exhaust airflow rating at a pressure of 0.25 in. w.g. may be used, provided the duct sizing meets the prescriptive requirements of Table 403.4.7.2.
   2. Where a range hood or down draft exhaust fan is used to satisfy the local ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 cfm at 0.10 in. w.g.
3. Design and installation of the system or equipment shall be carried out in accordance with manufacturers' installation instructions.
4. Intermittent local exhaust system serving kitchens shall be rated for sound at a maximum of 3 sones at one or more airflow settings not less than 100 cfm at a static pressure not less than that determined at working speed as specified in HVI 916 Section 7.2.
5. Continuous local exhaust system serving kitchens shall be rated for sound at a maximum of 1 sone at one or more airflow settings not less than 100 cfm at a static pressure not less than that determined at working speed as specified in HVI 916 Section 7.2.

Exceptions:

1. The installed airflow is not required to be field-verified where an exhaust airflow rating at a pressure of 0.25 in. w.g. may be used, provided the duct sizing meets the prescriptive requirements of Table 403.4.7.2.
2. Remote mounted fans need not meet sound requirements. To be considered for this exception, a remote mounted fan shall be mounted outside the kitchen, and there shall be at least 4 feet (1 m) of ductwork between the fan and the intake grille.

[W] TABLE 403.4.7.2
PRESCRIPTIVE EXHAUST DUCT SIZING

FAN TESTED CFM AT 0.25 INCHES W.G.	MINIMUM FLEX DIAMETER	MAXIMUM LENGTH IN FEET	MINIMUM SMOOTH DIAMETER	MAXIMUM LENGTH IN FEET	MAXIMUM ELBOWS[a]
50	4 inches	25	4 inches	70	3
50	5 inches	90	5 inches	100	3
50	6 inches	No Limit	6 inches	No Limit	3
80	4 inches[b]	NA	4 inches	20	3
80	5 inches	15	5 inches	100	3
80	6 inches	90	6 inches	No Limit	3
100	5 inches[b]	NA	5 inches	50	3
100	6 inches	45	6 inches	No Limit	3
125	6 inches	15	6 inches	No Limit	3
125	7 inches	70	7 inches	No Limit	3

a. For each additional elbow, subtract 10 feet from length.
b. Flex ducts of this diameter are not permitted with fans of this size.

[W] 403.4.7.3 Local intermittent kitchen exhaust system. Kitchen range hoods for domestic cooking appliances shall meet or exceed either the minimum airflow or the minimum capture efficiency in accordance with Table 403.4.7.3. Capture efficiency ratings shall be determined in accordance with ASTM E3087.

Exception: Other intermittent kitchen exhaust fans, including downdraft, shall meet or exceed 300 cfm airflow.

Table 403.4.7.3
Kitchen Range Hood Airflow Rates (CFM) and ASTM E3087 Capture Efficiency (CE) Ratings According to Kitchen Range Fuel Type

Hood Over Electric Range	Hood Over Combustion Range
65 percent CE or 160 cfm	80 percent CE or 250 cfm

403.4.7.3.1 Field verification and diagnostic testing for local intermittent kitchen exhaust system. The local exhaust system for kitchens shall be installed to comply with local mechanical exhaust requirements specified in Section 403.4.7.3 and shall be field verified in accordance with the procedures below to confirm the model is rated by HVI or AHAM to comply with the following requirements:

1. Local intermittent exhaust system for kitchens shall be tested and verified to provide a minimum airflow rate or capture efficiency required by Section 403.4.7.3. Testing shall include verification of the maximum sound rating as specified in Section 403.4.7.2. Testing for the intermittent kitchen exhaust systems shall occur with the whole house ventilation system operating and with all dwelling unit or sleeping unit entry doors closed. Testing for exhaust systems that require mechanical makeup air in accordance with Section 505.4 shall include verifying that the mechanical makeup air opening is open. Testing for exhaust systems that require mechanical makeup air in accordance with Section 505.4 shall include verifying that the mechanical makeup air system is controlled to automatically start. Testing for exhaust systems that do not require mechanical makeup air in accordance with Section 505.4 and that are exempt from pressurize equalization per Section 501.4 shall be tested with operable openings manually opened unless design exhaust airflow can be achieved with all operable openings closed. Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official.

   Exception: The installed airflow is not required to be field-verified where an exhaust airflow rating at a pressure of 0.25 inches w.g. is used, provided the duct sizing meets the prescriptive requirements of Table 403.4.7.2.

2. The verification shall utilize certified rating data from HVI Publication 911, *AHAM-Certified Range Hood Directory* or another directory of certified product performance ratings approved by the code official for determining compliance. The verification procedure shall consist of visual inspection of the local intermittent kitchen exhaust system to verify and record the following information:
    2.1. The manufacturer name and model number.
    2.2. The model is listed in the HVI, AHAM, or equivalent directory.
    2.3. The rated airflow value listed in the HVI, AHAM or equivalent directory.
    2.4. The sound rating value listed in the HVI, AHAM or equivalent directory.
    2.5. If the value for the rated airflow given in the directory is greater than or equal to the airflow requirements specified in Section 403.4.7.3 and if the value for the sone rating given in the directory is less than or equal to the sone rating requirements specified in Section 403.4.7.2, then the local intermittent kitchen exhaust system complies, otherwise the local intermittent kitchen exhaust system does not comply.

[S] SECTION 404
ENCLOSED PARKING GARAGES, LOADING DOCKS AND MOTOR VEHICLE REPAIR GARAGES

[S] 404.1 Enclosed parking garages. Mechanical ventilation systems for enclosed parking garages shall operate continuously or shall be automatically operated by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Such detectors shall be listed in accordance with UL 2075 and installed in accordance with their listing and the manufacturer's instructions. Loss of communication with the carbon monoxide or nitrogen dioxide detectors shall cause the exhaust fans to operate continuously at full-on design airflow. Automatic operation shall cycle the ventilation system between the following two modes of operation:

1. Full-on at an airflow rate of not less than 0.75 cfm per square foot [0.0038 $m^3/(s \cdot m^2)$] of the floor area served.
2. Standby at an airflow rate of not less than 0.05 cfm per square foot [0.00025 $m^3/(s \cdot m^2)$] of the floor area served.

404.2 Occupied spaces accessory to public garages. Connecting offices, waiting rooms, ticket booths, and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with Section 403.3.1.

404.3 Enclosed loading dock. Mechanical ventilation systems for enclosed parking garages shall operate continuously or shall be automatically operated by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Such detectors shall be listed in accordance with UL 2075 and installed in accordance with their listing and the manufacturers' instructions. Loss of communication with the carbon monoxide or nitrogen dioxide detectors shall cause the exhaust fans to operate continuously at full-on design airflow. Automatic operation shall cycle the ventilation system between the following two modes of operation:

1. Full-on at an airflow rate of not less than 1.5 cfm per square foot [0.0076 $m^3/(s \cdot m^2)$] of the floor area served.
2. Standby at an airflow rate of not less than 0.30 cfm per square foot [0.00017 $m^3/(s \cdot m^2)$] of the floor area served.

404.4 Enclosed automated parking system areas. Mechanical ventilation systems for enclosed automated parking system areas where the engines of the motor vehicles are not operating shall operate continuously to provide a minimum airflow rate of 50 cfm per parking stall. This does not apply to the vehicle drop off area where vehicles are operating as these area shall comply with Section 404.1.

404.5 Motor vehicle repair garages. In buildings used for the repair of motor vehicles, each repair stall or stand shall be equipped with an exhaust capture system that connects directly to the repair engine exhaust source and prevents the escape of fumes. The exhaust system shall exhaust to the outdoor atmosphere. See Section 502.15 for additional requirements. Ventilation shall be provided for the motor vehicle repair garage in accordance with Section 404.1.

SECTION 405
SYSTEMS CONTROL

[S] 405.1 General. Mechanical ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the spaces are occupied. Air-conditioning systems that supply required *ventilation air* shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy. Additional mechanical system control requirements are contained in the International Energy Conservation Code.

SECTION 406
VENTILATION OF UNINHABITED SPACES

[S] 406.1 General. ((~~Uninhabited spaces, such as crawl~~)) Crawl spaces and attics ((~~,~~)) shall be provided with *natural ventilation* openings as required by the *International Building Code* or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than 0.02 cfm per square foot (0.00001 $m^3/s \cdot m^2$) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

SECTION 407
AMBULATORY CARE FACILITIES AND GROUP I-2 OCCUPANCIES

[W] 407.1 General. Mechanical ventilation for healthcare facilities licensed by Washington State shall be designed and installed in accordance with this code and the following provisions of the Washington Administrative Code (WAC):

1. Mechanical ventilation in ambulatory care facilities shall comply with chapter 246-330 WAC.
2. Mechanical ventilation for acute care hospitals shall comply with chapter 246-320 WAC.
3. Mechanical ventilation for nursing homes shall comply with chapter 388-97 WAC.

Mechanical ventilation for unlicensed ambulatory care facilities ((~~and Group I-2 *occupancies*~~)) shall be designed and installed in accordance with this code, ASHRAE 170 and NFPA 99.

CHAPTER 5
EXHAUSTSYSTEMS

User note:

About this chapter: *Chapter 5 addresses exhaust systems for, among others, kitchens, laboratories, processes, garages, hazardous systems, clothes dryers and smoke control systems. Many provisions are linked to the* International Fire Code®. *Exhaust systems mitigate health and fire hazards by removing and diluting contaminants in buildings. Exhaust system discharge location is also addressed as an important concern.*

SECTION 501
GENERAL

501.1 Scope. This chapter shall govern the design, construction and installation of mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking *appliances*; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502.

501.2 Independent system required. Single or combined mechanical exhaust systems for environmental air shall be independent of all other exhaust systems. Dryer, domestic kitchen and hazardous exhaust shall be independent of all other systems. Type I exhaust systems shall be independent of all other exhaust systems except as provided in Section 506.3.5. Single or combined Type II exhaust systems for food-processing operations shall be independent of all other exhaust systems. Commercial kitchen exhaust systems shall be constructed in accordance with Sections 506 through 509.

[S] 501.3 Exhaust discharge. The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a public nuisance and not less than the distances specified in Section 501.3.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic or crawl space, or be directed onto walkways.

Exceptions:

1. Whole-house ventilation-type attic fans shall be permitted to discharge into the attic space of *dwelling units* having private attics.
2. Commercial cooking recirculating systems are not required to discharge outdoors if the kitchen area has an exhaust system that is vented to the outside. Ventilation shall be provided in accordance with Chapter 4.
3. Where installed in accordance with the manufacturer's instructions and where mechanical or *natural ventilation* is otherwise provided in accordance with Chapter 4, *listed* and *labeled* domestic ductless range hoods shall not be required to discharge to the outdoors.

[W][S] 501.3.1 Location of exhaust outlets. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:

1. For ducts conveying explosive or flammable vapors, fumes or dusts: 30 feet (9144 mm) from property lines; 10 feet (3048 mm) from operable openings into ((~~buildings~~)) the building; 6 feet (1829 mm) from exterior walls and roofs; 30 feet (9144 mm) from combustible walls and operable openings into ((~~buildings that~~)) the building which are in the direction of the exhaust discharge; 10 feet (3048 mm) above adjoining grade.

Interpretation: Item 1 includes carpentry shop exhaust, industrial chemical lab, paint shop and sandblasting exhaust systems. For *clearances* and encroachments in the public right-of-way, see Section 304.13.

2. For other product-conveying outlets: 10 feet (3048 mm) from the property lines; 3 feet (914 mm) from exterior walls and roofs; 10 feet (3048 mm) from operable openings into buildings; 10 feet (3048 mm) above adjoining grade.

Interpretation: Item 2 includes central vacuum systems, dry cleaner, photo lab, school chemical lab, nail salon, dryer exhaust over 250° *source capture system* exhaust and *combustion* engine exhaust and refrigerant pipe shaft ventilation exhaust outlets covered under Section 1109.3.2 carrying Group A2L and Group B2L refrigerants.

[W] 3. For all *environmental air* exhaust other than enclosed parking garage and transformer vault exhaust: 3 feet (914 mm) from property lines, ((;)) 3 feet (914 mm) from operable openings into buildings for all *occupancies* other than Group U; and 10 feet (3048 mm) from mechanical air intakes. Such exhaust shall not be considered hazardous or

noxious. Separation is not required between intake air openings and ((~~living space *exhaust*~~)) environmental *air* other than kitchen exhaust openings of ((~~an individual~~)) the same *dwelling unit* or *sleeping unit* where an approved factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacturer's instructions.

Interpretation: For the purposes of this section, "lot line" includes any property line separating one lot from another lot, but does not include any property line separating a lot from a public street or alley right-of-way.

Exceptions:

1. The separation between an air intake and exhaust outlet on a single listed package HVAC unit.
2. Exhaust from environmental air systems other than garages may be discharged into an open parking garage.
3. Except for Group I occupancies, where ventilation system design circumstances require building HVAC air to be relieved, such as during economizer operation, such air may be relieved into an open or enclosed parking garage within the same building.

4. Exhaust outlets serving structures in flood hazard areas shall be installed at or above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment.
5. For enclosed parking garage, loading dock, and motor vehicle repair garage exhaust system outlets: Exhaust ventilation openings and duct terminations shall be located not less than 10 feet (3048 mm) from property lines which separate one lot from another; 10 feet from operable openings into buildings and mechanical air intakes; and 3 feet (914 mm) horizontally from, 10 feet above, or 10 feet below adjoining finished walking surfaces other than alleys. Exhaust outlets extending to the roof shall extend 3 feet (914 mm) above the roof surface.

[W][S] 6. For transformer vault exhaust system outlets: Exhaust ventilation openings and duct terminations, subject to the requirements of *Seattle Electrical Code* Section 450.45, shall be located not less than 10 feet (3048 mm) from:

6.1. Fire escapes;
6.2. Required means of egress at the exterior of the building;
6.3. Elements of the exit discharge;
6.4. Exterior combustible materials;
6.5. Openings that are not protected in accordance with IBC Section 705.8;
6.6. Property lines which separate one lot from another other than a public way;
6.7. Operable openings and mechanical intakes; and
6.8. Above or below any walking surface.

Exhaust outlets shall be located on the exterior of the building.

Note: See Seattle City Light Standard 751 Section 9 Ventilation and Seattle Building Code Section 430 for additional requirements.

[W] 7. For elevator machinery rooms in enclosed or open parking garages: Exhaust outlets may discharge air directly into the parking garage.

((~~5~~)) 8. For specific systems, see the following sections:

((~~5.1~~)) 8.1. Clothes dryer exhaust, Section 504.4.
((~~5.2~~)) 8.2. Kitchen hoods and other kitchen exhaust *equipment*, Sections 506.3.13, 506.4 and 506.5.
((~~5.3~~)) 8.3. Dust, stock and refuse conveying systems, Section 511.2.
((~~5.4~~)) 8.4. Subslab soil exhaust systems, Section 512.4.
((~~5.5~~)) 8.5. Smoke control systems, Section 513.10.3.
((~~5.6~~)) 8.6. Refrigerant discharge, Section 1105.7.
((~~5.7~~)) 8.7. *Machinery room* discharge, Section 1105.6.1.

Note: *Seattle Land Use Code* (Municipal Code Title 23) requires that the venting of odors, vapors, smoke, cinders, dust, gas and fumes shall be at least 10 feet (3048 mm) above finished sidewalk grade, and directed away as much as possible from residential uses within 50 feet (15 240 mm) of the vent in some locations.

501.3.2 Exhaust opening protection. Exhaust openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grilles shall be sized not less than 1/4 inch (6.4 mm) and not larger than 1/2 inch (12.7 mm). Openings shall be protected against local weather conditions. Louvers that protect exhaust

openings in structures located in hurricane-prone regions, as defined in the *International Building Code*, shall comply with AMCA Standard 550. Outdoor openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code*.

[W] 501.4 Pressure equalization. Mechanical exhaust systems shall be sized to remove the quantity of air required by this chapter to be exhausted. The system shall operate when air is required to be exhausted. Where mechanical exhaust is required in a room or space, ((~~in other than *occupancies* in Group R-3 and *dwelling units* in Group R-2,~~)) such space shall be maintained with a neutral or negative pressure. If a greater quantity of air is supplied by a mechanical ventilating supply system than is removed by a mechanical exhaust for a room, adequate means shall be provided for the natural or mechanical exhaust of the excess air supplied. If only a mechanical exhaust system is installed for a room or if a greater quantity of air is removed by a mechanical exhaust system than is supplied by a mechanical ventilating supply system for a room, adequate *makeup air* shall be provided to satisfy the deficiency.

Exception: Intermittent kitchen exhaust, intermittent domestic dryer exhaust, and intermittent local exhaust system in R-3 occupancies and dwelling units in R-2 occupancies are excluded from the pressure equalization requirement unless required by Section 504 or Section 505.

501.5 Ducts. Where exhaust duct construction is not specified in this chapter, such construction shall comply with Chapter 6.

SECTION 502
REQUIRED SYSTEMS

[S] 502.1 General. An exhaust system shall be provided, maintained and operated as specifically required by this section and for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders and other *appliances, equipment* and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or emit heat, odors, fumes, spray, gas or smoke in such quantities so as to be irritating or injurious to health or safety. These exhaust systems are considered *product-conveying* systems.

[S] 502.1.1 Exhaust inlet location. The inlet to an exhaust system shall be located in the area of heaviest concentration of contaminants.

[F] 502.1.2 Fuel-dispensing areas. The bottom of an air inlet or exhaust opening in fuel-dispensing areas shall be located not more than 18 inches (457 mm) above the floor.

502.1.3 Equipment, appliance and service rooms. *Equipment*, *appliance* and system service rooms that house sources of odors, fumes, noxious gases, smoke, steam, dust, spray or other contaminants shall be designed and constructed so as to prevent spreading of such contaminants to other occupied parts of the building.

[F] 502.1.4 Hazardous exhaust. The mechanical exhaust of high concentrations of dust or hazardous vapors shall conform to the requirements of Section 510.

[F] 502.2 Aircraft fueling and defueling. Compartments housing piping, pumps, air eliminators, water separators, hose reels and similar *equipment* used in aircraft fueling and defueling operations shall be adequately ventilated at floor level or within the floor itself.

[F] 502.3 Battery-charging areas for powered industrial trucks and equipment. Ventilation shall be provided in an *approved* manner in battery-charging areas for powered industrial trucks and *equipment* to prevent a dangerous accumulation of flammable gases.

[S][F] 502.4 ((~~Stationary storage battery~~)) Energy storage systems. ((~~Stationary storage battery~~)) Exhaust ventilation of rooms, areas and walk-in units containing electrochemical energy storage systems shall be regulated and ventilated in accordance with Section 1207.6.1 of the *International Fire Code*, this section, and the general requirements of this chapter.

502.4.1 Ventilation based on lower flammable limit (LFL). The exhaust ventilation system shall be designed to limit the maximum concentration of flammable gas to 25 percent of the lower flammable limit (LFL) of the total volume of the room, area or walk-in unit during the worst-case event of simultaneous charging of batteries at the maximum charge rate, in accordance with nationally recognized standards.

502.4.2 Ventilation based on exhaust rate. Mechanical exhaust ventilation shall be provided at a rate of not less than 1 $ft^3/min/ft^2$ (5.1 $L/sec/m^2$) of floor area of the room, area or walk-in unit. The ventilation shall be either continuous or shall be activated by a gas detection system in accordance with Seattle Fire Code Section 1207.6.1.2.4.

502.4.3 Energy storage system gas detection system. Where a gas detection system is installed that complies with *Seattle Fire Code* Section 916, the mechanical ventilation system shall remain on until the flammable gas detected is less than 25 percent of the LFL.

[F] 502.5 Ventilation of battery systems in cabinets. Stationary storage battery systems installed in cabinets shall be provided with ventilation in accordance with Section 502.4.

[F] 502.6 Dry cleaning plants. Ventilation in dry cleaning plants shall be adequate to protect employees and the public in accordance with this section and DOL 29 CFR Part 1910.1000, where applicable.

[F] 502.6.1 Type II systems. Type II dry cleaning systems shall be provided with a mechanical ventilation system that is designed to exhaust 1 cubic foot of air per minute for each square foot of floor area (1 cfm/ft^2) [0.00508 m^3/ (s • m^2)] in dry cleaning rooms and in drying rooms. The ventilation system shall operate automatically when the dry cleaning *equipment* is in operation and shall have manual controls at an *approved* location.

[F] 502.6.2 Type IV and V systems. Type IV and V dry cleaning systems shall be provided with an automatically activated exhaust ventilation system to maintain an air velocity of not less than 100 feet per minute (0.51 m/s) through the loading door when the door is opened.

Exception: Dry cleaning units are not required to be provided with exhaust ventilation where an exhaust hood is installed immediately outside of and above the loading door and operates at an airflow rate as follows:

$$Q = 100 \times A_{LD} \quad \textbf{(Equation 5-1)}$$

where:

Q = Flow rate exhausted through the hood, cubic feet per minute.

A_{LD} = Area of the loading door, square feet.

[F] 502.6.3 Spotting and pretreating. Scrubbing tubs, scouring, brushing or spotting operations shall be located such that solvent vapors are captured and exhausted by the ventilating system.

[S][F] 502.7 Application of flammable finishes. Mechanical exhaust as required by this section shall be provided for operations involving the application of flammable finishes. Spray finishing operations conducted in Group A, E, I or R *occupancies* shall be located in a spray room protected with an *approved* automatic sprinkler system installed in accordance with *International Building Code* Section 903.3.1.1 and separated vertically and horizontally from other areas in accordance with the *International Building Code*. In other *occupancies*, spray-finishing operations shall be conducted in a spray room, spray booth or limited spraying area *approved* for such use.

[F] 502.7.1 During construction. Ventilation shall be provided for operations involving the application of materials containing flammable solvents in the course of construction, *alteration* or demolition of a structure.

[S][F] 502.7.2 Limited spraying spaces. Positive mechanical ventilation that provides not less than six complete air changes per hour shall be installed in limited spraying spaces. Such system shall meet the requirements of the *International Fire Code* for handling flammable vapors. Explosion venting is not required.

Exception: Negative mechanical ventilation, providing a minimum of six complete air changes per hour, is allowed in lieu of positive mechanical ventilation if a fan rated for Class I, Division 2 hazardous locations in accordance with the *Seattle Electrical Code* is installed.

[F] 502.7.3 Flammable vapor areas. Mechanical ventilation of flammable vapor areas shall be provided in accordance with Sections 502.7.3.1 through 502.7.3.6.

[F] 502.7.3.1 Operation. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying *equipment* shall be interlocked with the ventilation of the flammable vapor area such that spraying operations cannot be conducted unless the ventilation system is in operation.

[F] 502.7.3.2 Recirculation. Air exhausted from spraying operations shall not be recirculated.

Exceptions:

1. Air exhausted from spraying operations shall be permitted to be recirculated as *makeup air* for unmanned spray operations provided that:
   - 1.1. The solid particulate has been removed.
   - 1.2. The vapor concentration is less than 25 percent of the lower flammable limit (LFL).
   - 1.3. *Approved equipment* is used to monitor the vapor concentration.
   - 1.4. An alarm is sounded and spray operations are automatically shut down if the vapor concentration exceeds 25 percent of the LFL.
   - 1.5. In the event of shutdown of the vapor concentration monitor, 100 percent of the air volume specified in Section 510 is automatically exhausted.
2. Air exhausted from spraying operations is allowed to be recirculated as *makeup air* to manned spraying operations where all of the conditions provided in Exception 1 are included in the installation and documents have been prepared to show that the installation does not pose a life safety hazard to personnel inside the spray booth, spraying space or spray room.

2. Workstations: A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.
3. Liquid storage rooms: Exhaust ventilation for liquid storage rooms shall comply with Section 502.8.1.1 and the *International Building Code*.
4. HPM rooms: Exhaust ventilation for HPM rooms shall comply with Section 502.8.1.1 and the *International Building Code*.
5. Gas cabinets: Exhaust ventilation for gas cabinets shall comply with Section 502.8.2. The gas cabinet ventilation system is allowed to connect to a workstation ventilation system. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.
6. Exhausted enclosures: Exhaust ventilation for exhausted enclosures shall comply with Section 502.8.2. Exhaust ventilation for exhausted enclosures containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.
7. Gas rooms: Exhaust ventilation for gas rooms shall comply with Section 502.8.2. Exhaust ventilation for gas rooms containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.
8. Cabinets containing pyrophoric liquids or Class 3 water-reactive liquids: Exhaust ventilation for cabinets in fabrication areas containing pyrophoric liquids shall be as required in Section 2705.2.3.4 of the *International Fire Code*.

[F] 502.10.2 Penetrations. Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 of the *International Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *International Building Code* shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls. Fire dampers shall not be installed in exhaust ducts.

[F] 502.10.3 Treatment systems. Treatment systems for highly toxic and toxic gases shall comply with the *International Fire Code*.

502.11 Motion picture projectors. Motion picture projectors shall be exhausted in accordance with Section 502.11.1 or 502.11.2.

502.11.1 Projectors with an exhaust discharge. Projectors equipped with an exhaust discharge shall be directly connected to a mechanical exhaust system. The exhaust system shall operate at an exhaust rate as indicated by the manufacturer's installation instructions.

502.11.2 Projectors without exhaust connection. Projectors without an exhaust connection shall have contaminants exhausted through a mechanical exhaust system. The exhaust rate for electric arc projectors shall be not less than 200 cubic feet per minute (cfm) (0.09 m^3/s) per lamp. The exhaust rate for xenon projectors shall be not less than 300 cfm (0.14 m^3/s) per lamp. Xenon projector exhaust shall be at a rate such that the exterior temperature of the lamp housing does not exceed 130°F (54°C). The lamp and projection room exhaust systems, whether combined or independent, shall not be interconnected with any other exhaust or return system within the building.

[F] 502.12 Organic coating processes. Enclosed structures involving organic coating processes in which Class I liquids are processed or handled shall be ventilated at a rate of not less than 1 cfm/ft^2 [0.00508 $m^3/(s \cdot m^2)$] of solid floor area. Ventilation shall be accomplished by exhaust fans that intake at floor levels and discharge to a safe location outside the structure. Noncontaminated intake air shall be introduced in such a manner that all portions of solid floor areas are provided with continuous uniformly distributed air movement.

502.13 Public garages. Mechanical exhaust systems for public garages, as required in Chapter 4, shall operate continuously or in accordance with Section 404.

[S] 502.14 Motor vehicle operation. In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 403. Additionally, areas in which stationary motor vehicles are operated shall be provided with a *source capture system* that connects directly to the motor vehicle exhaust systems. When the *source capture system* extends more than 10 feet from the tailpipe connection to the outdoors, the system shall exhaust at a rate of 600 cfm for heavy-duty diesel vehicles and at a rate of 300 cfm for all other vehicles. Such system shall be engineered by a registered design professional. ((~~or shall be factory-built *equipment* designed and sized for the purpose.~~))

Exceptions:

1. This section shall not apply where the motor vehicles being operated or repaired are electrically powered.
2. This section shall not apply to one- and two-family dwellings.
3. This section shall not apply to motor vehicle service areas where engines are operated inside the building only for the duration necessary to move the motor vehicles in and out of the building.

[S][F] 502.15 Repair garages and other spaces. Where Class I liquids or LP-gas are stored or used within a building having a basement or pit wherein flammable vapors could accumulate, the basement or pit shall be provided with ventilation designed to prevent the accumulation of flammable vapors therein.

[F] 502.16 Repair garages for vehicles fueled by lighter-than-air fuels. Repair garages used for the conversion and repair of vehicles that use compressed natural gas, liquefied natural gas, hydrogen or other lighter-than-air motor fuels shall be provided with an *approved* mechanical exhaust ventilation system. The mechanical exhaust ventilation system shall be in accordance with Section 502.16.1 or 502.16.2 as applicable.

Exceptions:

1. Repair garages where work is not performed on the fuel system and is limited to exchange of parts and maintenance not requiring open flame or welding on the compressed natural gas, liquefied natural gas, hydrogen or other lighter-than-air-fueled motor vehicle.
2. Repair garages for hydrogen-fueled vehicles where work is not performed on the hydrogen storage tank and is limited to the exchange of parts and maintenance not requiring open flame or welding on the hydrogen-fueled vehicle. During the work, the entire hydrogen fuel system shall contain a quantity of hydrogen that is less than 200 cubic feet (5.6 m^3).

[F] 502.16.1 Repair garages for hydrogen-fueled vehicles. Repair garages used for the repair of hydrogen-fueled vehicles shall be provided with an approved exhaust ventilation system in accordance with this code and Chapter 6 of NFPA 2.

[F] 502.16.2 Exhaust ventilation system. Repair garages used for the repair of compressed natural gas, liquefied natural gas or other lighter-than-air motor fuel, other than hydrogen, shall be provided with an approved mechanical exhaust ventilation system. The mechanical exhaust ventilation system shall be in accordance with this code and Sections 502.16.2.1 and 502.16.2.2.

Exception: Where approved, natural ventilation shall be an alternative to mechanical exhaust ventilation.

[F] 502.16.2.1 Design. For indoor locations, air supply inlets and exhaust outlets for mechanical ventilation shall be arranged to provide uniformly distributed air movement with inlets uniformly arranged on walls near floor level and outlets located at the high point of the room in walls or the roof.

Failure of the exhaust ventilation system shall cause the fueling system to shut down.

The exhaust ventilation rate shall be not less than 1 cubic foot per minute (0.03 m^3/min) per 12 cubic feet (0.34 m^3) of room volume.

[F] 502.16.2.2 Operation. The mechanical exhaust ventilation system shall operate continuously.

Exceptions:

1. Mechanical exhaust ventilation systems that are interlocked with a gas detection system designed in accordance with the *International Fire Code*.
2. Mechanical exhaust ventilation systems in garages that are used only for the repair of vehicles fueled by liquid fuels or odorized gases, such as compressed natural gas, where the exhaust ventilation system is electrically interlocked with the lighting circuit.

502.17 Tire rebuilding or recapping. Each room where rubber cement is used or mixed, or where flammable or combustible solvents are applied, shall be ventilated in accordance with the applicable provisions of NFPA 91.

502.17.1 Buffing machines. Each buffing machine shall be connected to a dust-collecting system that prevents the accumulation of the dust produced by the buffing process.

502.18 Specific rooms. Specific rooms, including bathrooms, locker rooms, smoking lounges and toilet rooms, shall be exhausted in accordance with the ventilation requirements of Chapter 4.

Informative Note: RCW 70.160.030 states: "No person may smoke in a public place or in any place of employment." A public place is defined in RCW 70.160.020 in part as: "…A public place does not include a private residence unless the private residence is used to provide licensed child care, foster care, adult care, or other similar social service care on the premises. This chapter is not intended to restrict smoking in private facilities which are occasionally open to the public except upon the occasions when the facility is open to the public."

502.19 Indoor firing ranges. Ventilation shall be provided in an *approved* manner in areas utilized as indoor firing ranges. Ventilation shall be designed to protect employees and the public in accordance with DOL 29 CFR 1910.1025 where applicable.

502.20 Manicure and pedicure stations. Manicure and pedicure stations shall be provided with an exhaust system in accordance with Table 403.3.1.1, Note h. Manicure tables and pedicure stations not provided with factory-installed exhaust inlets shall be provided with exhaust inlets located not more than 12 inches (305 mm) horizontally and vertically from the point of chemical application.

[S] 502.20.1 Operation. The exhaust system for manicure and pedicure stations shall have ((~~controls~~)) automatic control, occupancy sensors or other approved automatic controls, that operate the system continuously when the space is occupied.

SECTION 503
MOTORS AND FANS

503.1 General. Motors and fans shall be sized to provide the required air movement. Motors in areas that contain flammable vapors or dusts shall be of a type *approved* for such environments. A manually operated remote control installed at an *approved* location shall be provided to shut off fans or blowers in flammable vapor or dust systems. Electrical *equipment* and *appliances* used in operations that generate explosive or flammable vapors, fumes or dusts shall be interlocked with the ventilation system so that the *equipment* and *appliances* cannot be operated unless the ventilation fans are in operation. Motors for fans used to convey flammable vapors or dusts shall be located outside the duct or shall be protected with *approved* shields and dustproofing. Motors and fans shall be provided with a means of access for servicing and maintenance.

503.2 Fans. Parts of fans in contact with explosive or flammable vapors, fumes or dusts shall be of nonferrous or nonsparking materials, or their casing shall be lined or constructed of such material. Where the size and hardness of materials passing through a fan are capable of producing a spark, both the fan and the casing shall be of nonsparking materials. Where fans are required to be spark resistant, their bearings shall not be within the airstream, and all parts of the fan shall be grounded. Fans in systems-handling materials that are capable of clogging the blades, and fans in buffing or woodworking exhaust systems, shall be of the radial-blade or tube-axial type.

503.3 Equipment and appliance identification plate. *Equipment* and *appliances* used to exhaust explosive or flammable vapors, fumes or dusts shall bear an identification plate stating the ventilation rate for which the system was designed.

503.4 Corrosion-resistant fans. Fans located in systems conveying corrosives shall be of materials that are resistant to the corrosive or shall be coated with corrosion-resistant materials.

SECTION 504
CLOTHES DRYER EXHAUST

504.1 Installation. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions. Dryer exhaust systems shall convey the moisture and any products of *combustion* to the outside of the building.

Exception: This section shall not apply to *listed* and *labeled* condensing (ductless) clothes dryers.

504.2 Exhaust penetrations. Where a clothes dryer exhaust duct penetrates a wall or ceiling membrane, the annular space shall be sealed with noncombustible material, *approved* fire caulking or a noncombustible dryer exhaust duct wall receptacle. Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draft-stopping or any wall, floor/ceiling or other assembly required by the *International Building Code* to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating is maintained in accordance with the *International Building Code*. Fire dampers, combination fire/smoke dampers and any similar devices that will obstruct the exhaust flow shall be prohibited in clothes dryer exhaust ducts.

[S] 504.2.1 Protection required. Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 1-1/4 inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, have a thickness of 0.062 inch (1.6 mm) and extend a minimum of 2 inches (51 mm) above sole plates and below top plates.

504.3 Cleanout. Each vertical riser shall be provided with a means for cleanout.

[W] 504.4 Exhaust installation. Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building and shall be equipped with a backdraft damper located where the duct terminates. Dryer exhaust ducts may terminate at exterior wall louvers with openings spaced not less than 1/2" in any direction. Screens shall not be installed at the duct termination. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. Clothes dryer exhaust ducts shall not be connected to a vent connector, vent or *chimney*. Clothes dryer exhaust ducts shall not extend into or through ducts or *plenums*. ((~~Clothes dryer exhaust ducts shall be sealed in accordance with Section 603.9.~~)) Domestic dryer exhaust ducts may terminate at a common exhaust location where each duct has an independent back-draft damper.

504.4.1 Termination location. Exhaust duct terminations shall be in accordance with the dryer manufacturer's installation instructions. Where the manufacturer's instructions do not specify a termination location, the exhaust duct shall terminate not less than 3 feet (914 mm) in any direction from openings into buildings, including openings in ventilated soffits.

504.4.2 Exhaust termination outlet and passageway size. The passageway of dryer exhaust duct terminals shall be undiminished in size and shall provide an open area of not less than 12.5 square inches (8065 mm^2).

504.5 Dryer exhaust duct power ventilators. Domestic dryer exhaust duct power ventilators shall be *listed* and *labeled* to UL 705 for use in dryer exhaust duct systems. The dryer exhaust duct power ventilator shall be installed in accordance with the manufacturer's instructions.

504.6 Booster fans prohibited. Domestic booster fans shall not be installed in dryer exhaust systems.

504.7 Makeup air. Installations exhausting more than 200 cfm (0.09 m^3/s) shall be provided with *makeup air*. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches (0.0645 m^2) shall be provided in the closet enclosure or *makeup air* shall be provided by other *approved* means.

[S] ((~~504.8 Protection required.~~ ~~Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 1-1/4 inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, have a thickness of 0.062 inch (1.6 mm) and extend not less than 2 inches (51 mm) above sole plates and below top plates.~~))

[S] ((~~504.9~~)) 504.8 Domestic clothes dryer ducts. Exhaust ducts for domestic clothes dryers shall conform to the requirements of Sections ((~~504.9.1 through 504.9.6~~)) 504.8.1 through 504.8.6 and Section 504.2.1.

[S] ((~~504.9.1~~)) 504.8.1 Material and size. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal not less than 0.016 inch (0.4 mm) in thickness. The exhaust duct size shall be 4 inches (102 mm) nominal in diameter.

[S] ((~~504.9.2~~)) 504.8.2 Duct installation. Exhaust ducts shall be supported at 4-foot (1219 mm) intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude more than 1/8 inch (3.2 mm) into the inside of the duct.

Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation.

[S] ((~~504.9.3~~)) 504.8.3 Transition ducts. Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is *listed* and *labeled* in accordance with UL 2158A. Transition ducts shall be not greater than 8 feet (2438 mm) in length and shall not be concealed within construction.

[S] ((~~504.9.4~~)) 504.8.4 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Sections ((~~504.9.4.1 through 504.9.4.3~~)) 504.8.4.1 and 504.8.4.2.

[S] ((~~504.9.4.1 Specified length.~~ ~~The maximum length of the exhaust duct shall be 35 feet (10 668 mm) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table 504.9.4.1.~~))

[S] TABLE ((~~504.9.4.1~~)) 504.8.4.1
DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH

DRYER EXHAUST DUCT FITTING TYPE	EQUIVALENT LENGTH
4″ radius mitered 45-degree elbow	2 feet 6 inches
4″ radius mitered 90-degree elbow	5 feet
6″ radius smooth 45-degree elbow	1 foot
6″ radius smooth 90-degree elbow	1 foot 9 inches
8″ radius smooth 45-degree elbow	1 foot
8″ radius smooth 90-degree elbow	1 foot 7 inches
10″ radius smooth 45-degree elbow	9 inches
10″ radius smooth 90-degree elbow	1 foot 6 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

[S] ((~~504.9.4.2~~)) 504.8.1 Manufacturer's instructions. The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer. Where the exhaust duct is to be concealed, the installation instructions shall be provided to the code official prior to the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table ((~~504.9.4.1~~)) 504.8.4.1 shall be used.

[S] ((~~504.9.4.3~~)) 504.8.4.2 Dryer exhaust duct power ventilator length. The maximum length of the exhaust duct shall be determined by the dryer exhaust duct power ventilator manufacturer's installation instructions.

[S] ((~~504.9.5~~)) 504.8.5 Length identification. Where the exhaust duct equivalent length exceeds 35 feet (10 668 mm), the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet (1829 mm) of the exhaust duct connection.

[S] ((~~504.9.6~~)) 504.8.6 Exhaust duct required. Where space for a clothes dryer is provided, an exhaust duct system shall be installed. Where the clothes dryer is not installed at the time of occupancy, the exhaust duct shall be capped at the location of the future dryer.

Exception: Where a *listed* condensing clothes dryer is installed prior to occupancy of structure.

[S] ((~~504.10~~)) 504.9 Commercial clothes dryers. The installation of dryer exhaust ducts serving commercial clothes dryers shall comply with the *appliance* manufacturer's installation instructions. Exhaust fan motors installed in exhaust systems shall

be located outside of the airstream. In multiple installations, the fan shall operate continuously or be interlocked to operate when any individual unit is operating. Ducts shall have a minimum *clearance* of 6 inches (152 mm) to combustible materials. Clothes dryer transition ducts used to connect the *appliance* to the exhaust duct system shall be limited to single lengths not to exceed 8 feet (2438 mm) in length and shall be *listed* and *labeled* for the application. Transition ducts shall not be concealed within construction.

[W][S] ((~~504.11~~)) 504.10 Common exhaust systems for clothes dryers located in multistory structures. Where a common multistory duct system is designed and installed to convey exhaust from multiple clothes dryers, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *International Building Code*.
2. Dampers shall be prohibited in the exhaust duct. Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5, Exception 2.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage) and in accordance with SMACNA Duct Construction Standards.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a legally required standby power source.
8. Exhaust fan operation shall be monitored in an *approved* location and shall initiate an audible or visual signal when the fan is not in operation.
9. *Makeup air* shall be provided for the exhaust system to maintain the minimum flow for the exhaust fan when the dryers are not operating. Additionally, *makeup air* shall be provided when required by Section 504.7.
10. A cleanout opening shall be located at the base of the shaft to provide *access* to the duct to allow for cleaning and inspection. The finished opening shall be not less than 12 inches by 12 inches (305 mm by 305 mm).
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only clothes dryers and shall be independent of other exhaust systems.

SECTION 505
DOMESTIC COOKING EXHAUST EQUIPMENT

505.1 General. Domestic cooking exhaust *equipment* shall comply with the requirements of this section.

505.2 Domestic cooking exhaust. Where domestic cooking exhaust *equipment* is provided, it shall comply with the following as applicable:

1. The fan for overhead range hoods and downdraft exhaust *equipment* not integral with the cooking *appliance* shall be *listed* and *labeled* in accordance with UL 507.
2. Overhead range hoods and downdraft exhaust *equipment* with integral fans shall comply with UL 507.
3. Domestic cooking *appliances* with integral downdraft exhaust *equipment* shall be *listed* and *labeled* in accordance with UL 858 or ANSI Z21.1.
4. Microwave ovens with integral exhaust for installation over the cooking surface shall be *listed* and *labeled* in accordance with UL 923.

[W][S] 505.3 ((~~Exhaust~~)) Domestic cooking exhaust ducts. ((~~Domestic~~)) Ducts serving domestic cooking exhaust *equipment* shall discharge to the outdoors through sheet metal ducts constructed of galvanized steel, stainless steel, aluminum or copper. Such ducts shall have smooth inner walls, shall be airtight, ((~~and~~)) shall be equipped with a backdraft damper, and shall be independent of all other exhaust systems. Installations in Group I-1 and I-2 *occupancies* shall be in accordance with the *International Building Code* and Section 904.14 of the *International Fire Code*.

Domestic kitchen exhaust ducts may terminate with other domestic dryer exhaust and residential local exhaust ducts at a common location where each duct has an independent backdraft damper.

Listed and labeled exhaust booster fans shall be permitted when installed in accordance with the manufacturer's installation instructions.

Exceptions:

1. In other than Groups I-1 and I-2, where installed in accordance with the manufacturer's instructions and where ((~~mechanical or natural ventilation is otherwise provided in accordance with Chapter 4~~)) continuous local exhaust is

provided in an *enclosed kitchen* in accordance with Table 403.4.7, *listed* and *labeled* ductless range hoods shall not be required to discharge to the outdoors. The local exhaust from the residential dwelling or sleeping unit kitchen area may be combined with the local bathroom exhaust ductwork where the exhaust register/grille in the kitchen is a minimum of 6 feet from the domestic range cooktop. The exhaust register/grille shall be provided with a minimum MERV 3 filter or mesh filter (washable) for trapping grease.

Interpretation: Chapter 4 requires separate *local exhaust* systems in kitchens, including where ductless range hoods (also known as recirculating hoods) are used. Ductless range hoods are permitted in *dwelling units* where exhaust systems in the kitchen meet the requirements for *local exhaust*. In no case is *natural ventilation*, such as an operable window, allowed to substitute for the required kitchen *local exhaust* system.

2. Ducts for domestic kitchen cooking *appliances* equipped with downdraft exhaust systems shall be permitted to be constructed of Schedule 40 PVC pipe and fittings provided that the installation complies with all of the following:
   2.1. The duct shall be installed under a concrete slab poured on grade.
   2.2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel.
   2.3. The PVC duct shall extend not more than 1 inch (25 mm) above the indoor concrete floor surface.
   2.4. The PVC duct shall extend not more than 1 inch (25 mm) above grade outside of the building.
   2.5. The PVC ducts shall be solvent cemented.

505.4 Makeup air required Exhaust hood systems capable of exhausting in excess of 400 cfm (0.19 m^3/s) shall be provided with *makeup air* at a rate approximately equal to the *exhaust air* rate. Such *makeup air* systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

[S] 505.5 Common exhaust systems for domestic kitchens located in multistory structures. Where a common multistory duct system is designed and installed to convey exhaust from multiple domestic kitchen exhaust systems, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *International Building Code*.
2. Dampers shall be prohibited in the exhaust duct, except as specified in Section 505.3. Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5, Exception 2.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage) and in accordance with SMACNA Duct Construction Standards.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source.
8. Exhaust fan operation shall be monitored in an approved location and shall initiate an audible or visual signal when the fan is not in operation.
9. Where the exhaust rate for an individual kitchen exceeds 400 cfm (0.19 m^3/s) *makeup air* shall be provided in accordance with Section 505.4.
10. A cleanout opening shall be located at the base of the shaft to provide access to the duct to allow for cleanout and inspection. The finished openings shall be not less than 12 inches by 12 inches (305 mm by 305 mm).
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only kitchen exhaust and shall be independent of other exhaust systems.

    Exception: Where labeled ductless range hoods are provided the local exhaust from the residential dwelling or sleeping unit kitchen area may be combined with the local bathroom exhaust ductwork where the exhaust register/grille in the kitchen is a minimum of 6 feet from the domestic range cooktop. The exhaust register/grille shall be provided with a minimum MERV 3 filter or mesh filter (washable) for trapping grease.

505.6 Other than Group R. In other than Group R *occupancies*, where domestic cooktops, ranges, and open-top broilers are used for domestic purposes, domestic cooking exhaust systems shall be provided.

[W] 506.3.2.4 Vibration isolation. A vibration isolation connector for connecting a duct to a fan shall consist of noncombustible packing in a metal sleeve joint of *approved* design or shall be a coated-fabric flexible duct connector ((~~*listed* and *labeled* for the application~~)) rated for continuous duty at temperature of not less than 1500°F (816°C). Vibration isolation connectors shall be installed only at the connection of a duct to a fan inlet or outlet.

506.3.2.5 Grease duct test. Prior to the use or concealment of any portion of a grease duct system, a leakage test shall be performed. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides. The permit holder shall be responsible to provide the necessary *equipment* and perform the grease duct leakage test. A light test shall be performed to determine that all welded and brazed joints are liquid tight.

A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open so as to emit light equally in all directions perpendicular to the duct walls. A test shall be performed for the entire duct system, including the hood-to-duct connection. The duct work shall be permitted to be tested in sections, provided that every joint is tested. For *listed* factory-built grease ducts, this test shall be limited to duct joints assembled in the field and shall exclude factory welds.

506.3.3 Grease duct supports. Grease duct bracing and supports shall be of noncombustible material securely attached to the structure and designed to carry gravity and seismic loads within the stress limitations of the *International Building Code*. Bolts, screws, rivets and other mechanical fasteners shall not penetrate duct walls.

506.3.4 Air velocity. Grease duct systems serving a Type I hood shall be designed and installed to provide an air velocity within the duct system of not less than 500 feet per minute (2.5 m/s).

Exception: The velocity limitations shall not apply within duct transitions utilized to connect ducts to differently sized or shaped openings in hoods and fans, provided that such transitions do not exceed 3 feet (914 mm) in length and are designed to prevent the trapping of grease.

[S] 506.3.5 Separation of grease duct system. A separate grease duct system shall be provided for each Type I hood. ((~~A separate grease duct system is not required~~)) Multiple Type I hoods are permitted to be combined where all of the following conditions are met:

1. All interconnected hoods are located within the same story.
2. All interconnected hoods are located within the same room or in adjoining rooms.
3. Interconnecting ducts do not penetrate assemblies required to be fire-resistance rated.
4. The grease duct system does not serve solid-fuel-fired *appliances*.

506.3.6 Grease duct clearances. Where enclosures are not required, grease duct systems and exhaust *equipment* serving a Type I hood shall have a *clearance* to combustible construction of not less than 18 inches (457 mm), and shall have a *clearance* to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 3 inches (76 mm).

Exceptions:

1. Factory-built commercial kitchen grease ducts *listed* and *labeled* in accordance with UL 1978.
2. *Listed* and *labeled* exhaust *equipment* installed in accordance with Section 304.1.
3. Where commercial kitchen grease ducts are continuously covered on all sides with a *listed* and *labeled* field-applied grease duct enclosure material, system, product or method of construction specifically evaluated for such purpose in accordance with ASTM E2336, the required *clearance* shall be in accordance with the listing of such material, system, product or method.

[S] 506.3.7 Prevention of grease accumulation in grease ducts. Duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof, and the system shall slope not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) toward the hood or toward a grease reservoir designed and installed in accordance with Section 506.3.7.1. Where horizontal ducts exceed 75 feet (22 860 mm) in length, the slope shall be not less than 1 unit vertical in 12 units horizontal (8.3-percent slope). Obstructions in the ductwork, such as duct-mounted sound attenuators or perforated acoustical louvers, are required to be listed and labeled per NFPA 96, UL 1978, or other applicable standard approved by the code official.

Exception: Factory-built grease ducts shall be installed at a slope that is in accordance with the listing and manufacturer's installation instructions.

506.3.7.1 Grease duct reservoirs. Grease duct reservoirs shall:

1. Be constructed as required for the grease duct they serve.
2. Be located on the bottom of the horizontal duct or the bottommost section of the duct riser.
3. Extend across the full width of the duct and have a length of not less than 12 inches (305 mm).

4. Have a depth of not less than 1 inch (25 mm).
5. Have a bottom that slopes to a drain.
6. Be provided with a cleanout opening constructed in accordance with Section 506.3.8 and installed to provide direct access to the reservoir. The cleanout opening shall be located on a side or on top of the duct so as to permit cleaning of the reservoir.
7. Be installed in accordance with the manufacturer's instructions where manufactured devices are utilized.

506.3.8 Grease duct cleanouts and openings. Grease duct cleanouts and openings shall comply with all of the following:

1. Grease ducts shall not have openings except where required for the operation and maintenance of the system.
2. Sections of grease ducts that are inaccessible from the hood or discharge openings shall be provided with cleanout openings spaced not more than 20 feet (6096 mm) apart and not more than 10 feet (3048 mm) from changes in direction greater than 45 degrees (0.79 rad).
3. Cleanouts and openings shall be equipped with tight-fitting doors constructed of steel having a thickness not less than that required for the duct.
4. Cleanout doors shall be installed liquid tight.
5. Door assemblies including any frames and gaskets shall be approved for the application and shall not have fasteners that penetrate the duct.
6. Gasket and sealing materials shall be rated for not less than 1,500ºF (816ºC).
7. Listed door assemblies shall be installed in accordance with the manufacturer's instructions.

506.3.8.1 Personnel entry. Where ductwork is large enough to allow entry of personnel, not less than one *approved* or *listed* opening having dimensions not less than 22 inches by 20 inches (559 mm by 508 mm) shall be provided in the horizontal sections, and in the top of vertical risers. Where such entry is provided, the duct and its supports shall be capable of supporting the additional load, and the cleanouts specified in Section 506.3.8 are not required.

506.3.8.2 Cleanouts serving in-line fans. A cleanout shall be provided for both the inlet side and outlet side of an in-line fan except where a duct does not connect to the fan. Such cleanouts shall be located within 3 feet (914 mm) of the fan duct connections.

[S] 506.3.9 Grease duct cleanout location, spacing and installation.

506.3.9.1 Grease duct horizontal cleanouts. Cleanouts serving horizontal sections of grease ducts shall:

1. Be spaced not more than 20 feet (6096 mm) apart.
2. Be located not more than 10 feet (3048 mm) from changes in direction that are greater than 45 degrees (0.79 rad).
3. Be located on the bottom only where other locations are not available and shall be provided with internal damming of the opening such that grease will flow past the opening without pooling. Bottom cleanouts and openings shall be approved for the application and installed liquid tight.
4. Not be closer than 1 inch (25 mm) from the edges of the duct.
5. Have opening dimensions of not less than 12 inches by 12 inches (305 mm by 305 mm). Where such dimensions preclude installation, the openings shall be not less than 12 inches (305 mm) on one side and shall be large enough to provide access for cleaning and maintenance.
6. Be located at grease reservoirs.
7. Be located within 3 feet (914 mm) of horizontal discharge fans.

[W][S] 506.3.9.2 Grease duct vertical cleanouts. Where ducts pass vertically through floors, cleanouts shall be provided. A minimum of one cleanout shall be provided on each floor. Cleanout openings shall be not less than 1-1/2 inches (38 mm) from all outside edges of the duct or welded seams. The opening minimum dimensions shall be 12 inches (305 mm) on each side.

506.3.10 Underground grease duct installation. Underground grease duct installations shall comply with all of the following:

1. Underground grease ducts shall be constructed of steel having a minimum thickness of 0.0575 inch (1.463 mm) (No. 16 gage) and shall be coated to provide protection from corrosion or shall be constructed of stainless steel having a minimum thickness of 0.0450 inch (1.140 mm) (No. 18 gage).
2. The underground duct system shall be tested and approved in accordance with Section 506.3.2.5 prior to coating or placement in the ground.
3. The underground duct system shall be completely encased in concrete with a minimum thickness of 4 inches (102 mm).
4. Ducts shall slope toward grease reservoirs.

5. A grease reservoir with a cleanout to allow cleaning of the reservoir shall be provided at the base of each vertical duct riser.
6. Cleanouts shall be provided with access to permit cleaning and inspection of the duct in accordance with Section 506.3.
7. Cleanouts in horizontal ducts shall be installed on the topside of the duct.
8. Cleanout locations shall be legibly identified at the point of access from the interior space.

[W][S] 506.3.11 Grease duct enclosures. A commercial kitchen grease duct serving a Type I hood that penetrates a ceiling, wall, floor or any concealed spaces shall be enclosed from the point of penetration to the outlet terminal. In-line exhaust fans not located outdoors shall be enclosed as required for grease ducts. A duct shall penetrate exterior walls only at locations where unprotected openings are permitted by the *International Building Code*. The duct enclosure shall serve a single grease duct and shall not contain other ducts, piping or wiring systems. Duct enclosures shall be a shaft enclosure in accordance with Section 506.3.11.1, a field-applied enclosure assembly in accordance with Section 506.3.11.2 or a factory-built enclosure assembly in accordance with Section 506.3.11.3. Duct enclosures shall have a fire-resistance rating of not less than that of the assembly penetrated. ((~~and not less than 1 hour.~~)) The duct enclosure need not exceed 2 hours but shall not be less than 1 hour. Fire dampers and smoke dampers shall not be installed in grease ducts.

Exceptions:

1. A duct enclosure shall not be required for a grease duct that penetrates only a nonfire-resistance-rated roof/ceiling assembly.
2. In buildings that are designed in accordance with *International Building Code* Section 510.2, grease duct enclosures that penetrate the 3-hour horizontal assembly are permitted to be protected in accordance with the exception to Section 510.2 Item 3.

506.3.11.1 Shaft enclosure. Grease ducts constructed in accordance with Section 506.3.1 shall be permitted to be enclosed in accordance with the *International Building Code* requirements for shaft construction. Such grease duct systems and exhaust *equipment* shall have a *clearance* to combustible construction of not less than 18 inches (457 mm), and shall have a *clearance* to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 6 inches (152 mm). Duct enclosures shall be sealed around the duct at the point of penetration and vented to the outside of the building through the use of weather-protected openings.

Interpretation: Gypsum wallboard installed on a combustible substrate or on wood studs does not cause the wall to be considered as a noncombustible assembly, and the 18 inch minimum *clearance* still applies. The classification of combustible and noncombustible materials is not changed by the use of fire-retardant-treated wood products or fire rated (Type "X") gypsum wallboard.

506.3.11.2 Field-applied grease duct enclosure. Grease ducts constructed in accordance with Section 506.3.1 shall be enclosed by a *listed* and *labeled* field-applied grease duct enclosure material, systems, product, or method of construction specifically evaluated for such purpose in accordance with ASTM E2336. The surface of the duct shall be continuously covered on all sides from the point at which the duct originates to the outlet terminal. Duct penetrations shall be protected with a through-penetration firestop system tested and *listed* in accordance with ASTM E814 or UL 1479 and having a "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. The grease duct enclosure and firestop system shall be installed in accordance with the listing and the manufacturer's instructions. Partial application of a field-applied grease duct enclosure shall not be installed for the sole purpose of reducing *clearances* to combustibles at isolated sections of grease duct. Exposed duct-wrap systems shall be protected where subject to physical damage.

506.3.11.3 Factory-built grease duct enclosure assemblies. Factory-built grease ducts incorporating integral enclosure materials shall be *listed* and *labeled* for use as grease duct enclosure assemblies specifically evaluated for such purpose in accordance with UL 2221. Duct penetrations shall be protected with a through-penetration firestop system tested and *listed* in accordance with ASTM E814 or UL 1479 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. The grease duct enclosure assembly and firestop system shall be installed in accordance with the listing and the manufacturer's instructions.

506.3.12 Grease duct fire-resistive access opening. Where cleanout openings are located in ducts within a fire-resistance-rated enclosure, access openings shall be provided in the enclosure at each cleanout point. Access openings shall be equipped with tight-fitting sliding or hinged doors that are equal in fire-resistive protection to that of the shaft or enclosure. An *approved* sign shall be placed on access opening panels with wording as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

506.3.13 Exhaust outlets serving Type I hoods. Exhaust outlets for grease ducts serving Type I hoods shall conform to the requirements of Sections 506.3.13.1 through 506.3.13.3.

506.3.13.1 Termination above the roof. Exhaust outlets that terminate above the roof shall have the discharge opening located not less than 40 inches (1016 mm) above the roof surface.

[S] 506.3.13.2 Termination through an exterior wall. Exhaust outlets shall be permitted to terminate through exterior walls where the smoke, grease, gases, vapors and odors in the discharge from such terminations do not create a public nuisance or a fire hazard. The installation of a pollution control unit in conjunction with an exhaust outlet shall be an approved method of eliminating smoke, grease, vapors and odors from discharging to the exterior. Such terminations shall not be located where protected openings are required by the *International Building Code*. Such terminations shall be located in accordance with Section 506.3.13.3 and shall not be located within 3 feet (914 mm) of any opening in the exterior wall except non-openable windows glazed with tempered or wired glass. The discharge outlets shall be not less than 10 feet (3.048 m) above the sidewalk or other walks, drives, streets or alleys. No portion of an exhaust outlet shall protrude into a public place less than 16 feet (4.876 m) above the ground. Whenever any portion of the exhaust outlet or duct protrudes beyond the property line over a public place, it is subject to the permit requirements of the Seattle Department of Transportation.

Note: See Director's Rule for the conditions where Type I hoods that are part of small commercial kitchen exhaust systems in taller buildings may be permitted to terminate at an exterior wall.

506.3.13.3 Termination location. Exhaust outlets shall be located not less than 10 feet (3048 mm) horizontally from parts of the same or contiguous buildings, adjacent buildings and adjacent property lines and shall be located not less than 10 feet (3048 mm) above the adjoining grade level. Exhaust outlets shall be located not less than 10 feet (3048 mm) horizontally from or not less than 3 feet (914 mm) above air intake openings into any building.

Exception: Exhaust outlets shall terminate not less than 5 feet (1524 mm) horizontally from parts of the same or contiguous building, an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations.

[S] 506.4 Ducts serving Type II hoods. Commercial kitchen exhaust systems serving Type II hoods shall comply with Sections 506.4.1 and 506.4.2.

Interpretation: For purposes of this section, property line includes any property line separating one lot from another lot, but does not include any property line separating a lot from a public street or alley right-of-way.

506.4.1 Ducts. Ducts and *plenums* serving Type II hoods shall be constructed of rigid metallic materials. Duct construction, installation, bracing and supports shall comply with Chapter 6. A duct serving a Type II hood that penetrates a fire-resistance-rated ceiling, floor or wall shall be in a rated enclosure from the point of penetration to the outlet with a rating equal to the fire-resistance rating of the assembly being penetrated. Ducts subject to positive pressure and ducts conveying moisture-laden or waste-heat-laden air shall be constructed, joined and sealed in an *approved* manner.

506.4.2 Type II terminations. Exhaust outlets serving Type II hoods shall terminate in accordance with the hood manufacturer's installation instructions and shall comply with all of the following:

1. Exhaust outlets shall terminate not less than 3 feet (914 mm) in any direction from openings into the building.
2. Outlets shall terminate not less than 10 feet (3048 mm) from property lines or buildings on the same lot.
3. Outlets shall terminate not less than 10 feet (3048 mm) above grade.
4. Outlets that terminate above a roof shall terminate not less than 30 inches (762 mm) above the roof surface.
5. Outlets shall terminate not less than 30 inches (762 mm) from exterior vertical walls.
6. Outlets shall be protected against local weather conditions.
7. Outlets shall not be directed onto walkways.
8. Outlets shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code*.

506.5 Exhaust equipment. Exhaust *equipment*, including fans and grease reservoirs, shall comply with Sections 506.5.1 through 506.5.6 and shall be of an *approved* design or shall be *listed* for the application.

506.5.1 Exhaust fans. Exhaust fan housings serving a Type I hood shall be constructed as required for grease ducts in accordance with Section 506.3.1.1.

Exception: Fans *listed* and *labeled* in accordance with UL 762.

506.5.1.1 Fan motor. Exhaust fan motors shall be located outside of the exhaust airstream.

506.5.1.2 In-line fan location. Where enclosed duct systems are connected to in-line fans not located outdoors, the fan shall be located in a room or space having the same fire-resistance rating as the duct enclosure. Access shall be provided

SECTION 507
COMMERCIAL KITCHEN HOODS

[S] 507.1 General. Commercial kitchen exhaust hoods shall comply with the requirements of this section. Hoods shall be Type I or II and shall be designed to capture and confine cooking vapors and residues. A Type I or Type II hood shall be installed at or above *appliances* in accordance with Sections 507.2 and 507.3 and Table 507.2.1. Where any cooking *appliance* under a single hood requires a Type I hood, a Type I hood shall be installed. Where a Type II hood is required, a Type I or Type II hood shall be installed. Where a Type I hood is installed, the installation of the entire system, including the hood, ducts, exhaust *equipment* and *makeup air* system shall comply with the requirements of Sections 506, 507, 508 and 509.

Exceptions:

1. Factory-built commercial exhaust hoods that are *listed* and *labeled* in accordance with UL 710, and installed in accordance with Section 304.1, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5.
2. Factory-built commercial cooking recirculating systems that are *listed* and *labeled* in accordance with UL 710B, and installed in accordance with Section 304.1, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5. Spaces in which such systems are located shall be considered to be kitchens and shall be ventilated in accordance with Table 403.3.1.1. The kitchen exhaust system shall discharge in accordance with Section 501.3.1, item 3. For the purpose of determining the floor area required to be ventilated, each individual *appliance* shall be considered as occupying not less than 100 square feet (9.3 m^2).
3. Where cooking *appliances* are equipped with integral down-draft exhaust systems and such *appliances* and exhaust systems are *listed* and *labeled* for the application in accordance with NFPA 96, a hood shall not be required at or above them.
4. Smoker ovens with integral exhaust systems, provided that the *appliance* is installed in accordance with the manufacturer's installation instructions, is listed and tested for the application, and complies with Chapter 5.

507.1.1 Operation. Commercial kitchen exhaust hood systems shall operate during the cooking operation. The hood exhaust rate shall comply with the listing of the hood or shall comply with Section 507.5. The exhaust fan serving a Type I hood shall have automatic controls that will activate the fan when any *appliance* that requires such Type I hood is turned on, or a means of interlock shall be provided that will prevent operation of such *appliances* when the exhaust fan is not turned on. Where one or more temperature or radiant energy sensors are used to activate a Type I hood exhaust fan, the fan shall activate not more than 15 minutes after the first *appliance* served by that hood has been turned on. A method of interlock between an exhaust hood system and *appliances* equipped with standing pilot burners shall not cause the pilot burners to be extinguished. A method of interlock between an exhaust hood system and cooking *appliances* shall not involve or depend on any component of a fire-extinguishing system.

The net exhaust volumes for hoods shall be permitted to be reduced during part-load cooking conditions, where engineered or *listed* multispeed or variable speed controls automatically operate the exhaust system to maintain capture and removal of cooking effluents as required by this section. Reduced volumes shall not be below that required to maintain capture and removal of effluents from the idle cooking *appliances* that are operating in a standby mode.

507.1.1.1 Multiple hoods utilizing a single exhaust system. Where heat or radiant energy sensors are utilized in hood systems consisting of multiple hoods served by a single exhaust system, such sensors shall be provided in each hood. Sensors shall be capable of being accessed from the hood outlet or from a cleanout location.

507.1.2 Domestic cooking appliances used for commercial purposes. Domestic cooking *appliances* utilized for commercial purposes shall be provided with Type I, ((~~or~~)) Type II or residential hoods ((~~as required for the type of *appliances* and processes~~)) in accordance with Sections 507.2 and 507.3 and Table 507.1.2. Domestic cooking *appliances* utilized for domestic cooking shall comply with Section 505.

[W][S] TABLE 507.1.2
TYPE OF HOOD REQUIRED FOR DOMESTIC COOKING APPLIANCES[1,2]

TYPE OF SPACE[3]	TYPE OF COOKING	TYPE OF HOOD
Places of Religious Worship	1) Boiling, steaming and warming precooked food	Type II
	2) Roasting, pan frying and deep frying	Type I
Community or party room in apartment and condominium	1) Boiling, steaming and warming precooked food	Residential hood[4] or Type II[5]
	2) Roasting, pan frying and deep frying	Type I
Day care	1) Boiling, steaming and warming precooked food	Residential hood[4] or Type II[5]
	2) Roasting, pan frying and deep frying	Type I
Dormitory, boarding home, nursing home	1) Boiling, steaming and warming precooked food	Type II
	2) Roasting, pan frying and deep frying	Type I
Office lunch room	1) Boiling, steaming and warming precooked food	Residential hood[4] or Type II[5]
	2) Roasting, pan frying and deep frying	Type I

1 *Commercial cooking appliances* shall comply with Section 507.2.
2 Requirements in this table apply to electric or gas fuel appliances only. Solid fuel appliances or charbroilers require Type I hoods.
3 The *code official* shall determine hood requirements for other types of spaces.
4 Residential hood shall vent to outside.
5 A Type II hood is required when the combined capacity of cooking appliances is more than 6 kW.

507.1.3 Fuel-burning appliances. Where vented fuel-burning *appliances* are located in the same room or space as the hood, provisions shall be made to prevent the hood system from interfering with normal operation of the *appliance* vents.

507.1.4 Cleaning. A hood shall be designed to provide for thorough cleaning of the entire hood.

507.1.5 Exhaust outlets. Exhaust outlets located within the hood shall be located so as to optimize the capture of particulate matter. Each outlet shall serve not more than a 12-foot (3658 mm) section of hood.

[S] 507.2 Type I hoods. Type I hoods shall be installed where cooking *appliances* produce grease or smoke as a result of the cooking process. Type I hoods shall be installed over *medium-duty*, *heavy-duty* and *extra-heavy-duty cooking appliances*.

Exceptions:

1. A Type I hood shall not be required for an electric cooking *appliance* where an approved testing agency provides documentation that the *appliance* effluent contains 5 mg/m^3 or less of grease when tested at an exhaust flow rate of 500 cfm (0.236 m^3/s) in accordance with UL 710B.
2. A Type I hood shall not be required in an R-2 an *occupancy* with not more than 16 residents.

507.2.1 Type I exhaust flow rate label. Type I hoods shall bear a label indicating the minimum exhaust flow rate in cfm per linear foot (1.55 L/s per linear meter) of hood that provides for capture and containment of the exhaust effluent for the cooking *appliances* served by the hood, based on the cooking *appliance* duty classifications defined in this code.

[S] TABLE 507.2.1
TYPE OF HOOD REQUIRED FOR COMMERCIAL COOKING APPLIANCES

TYPE OF APPLIANCE[1,7]	TYPE OF HOOD REQUIRED[2]		
	TYPE I[3]	TYPE II	NONE[6]
Baking oven	Solid fuel	> 6 kW	≤ 6 kW
Charbroiler	All sizes		
Coffee maker		> 12 kW	≤ 12 kW
Coffee roaster[4]		All sizes	
Convection ovens (electric)		> 6 kW	≤ 6 kW
Deep-fat fryer	All sizes		
Dishwasher		> 140°F	≤ 140°F
Grill	All sizes		
Hot dog display heater		> 6 kW	≤ 6 kW
Microwave oven			All sizes
Pastry oven		> 6 kW	≤ 6 kW
Pizza oven	Solid fuel	> 6 kW	≤ 6 kW
Popcorn maker		> 6 kW	≤ 6 kW
Roasting oven[5]	> 6 kW	≤ 6 kW	
Roll warmer		> 6 kW	≤ 6 kW

[S] TABLE 507.2.1—continued
TYPE OF HOOD REQUIRED FOR COMMERCIAL COOKING APPLIANCES

TYPE OF APPLIANCE[1,7]	TYPE OF HOOD REQUIRED[2]		
	TYPE I[3]	TYPE II	NONE[6]
Solid-fuel burning appliances	All sizes & all food products		
Soup warmer, soup preparation cooking unit		> 6 kW	≤ 6 kW
Steam reconstitution device		> 6 kW	≤ 6 kW
Steam table		> 6 kW	≤ 6 kW
Steamer		> 6 kW	≤ 6 kW
Toaster		> 6 kW	≤ 6 kW
Warming oven		> 6 kW	≤ 6 kW

1. The code official shall determine hood requirements for appliances not listed in the table.
2. Section 507.2 describes Type I and Type II kitchen hoods.
3. The definition of extra-heavy-duty cooking appliance includes all appliances utilizing solid fuel.
4. Puget Sound Clean Air Agency requires an after-burner for most coffee roasters to decrease particulates. See pscleanair.gov for more details.
5. Roasting ovens are used to cook raw or partially cooked food.
6. Where a cooking appliance is installed without hood under Section 507.1 exception or Table 507.2.1, general kitchen exhaust shall be required per Section 507.3.
7. A Type II hood is required when the combined capacity of cooking appliances, other than coffee makers, is more than 12 kW.

507.2.2 Type I extra-heavy-duty. Type I hoods for use over *extra-heavy-duty cooking appliances* shall not cover *heavy-*, *medium-* or *light-duty appliances*. Such hoods shall discharge to an exhaust system that is independent of other exhaust systems.

507.2.3 Type I materials. Type I hoods shall be constructed of steel having a minimum thickness of 0.0466 inch (1.181 mm) (No. 18 gage) or stainless steel not less than 0.0335 inch [0.8525 mm (No. 20 MSG)] in thickness.

507.2.4 Type I supports. Type I hoods shall be secured in place by noncombustible supports. Type I hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading and the possible weight of personnel working in or on the hood.

507.2.5 Type I hoods. External hood joints, seams and penetrations for Type I hoods shall be made with a continuous external liquid-tight weld or braze to the lowest outermost perimeter of the hood. Internal hood joints, seams, penetrations, filter support frames and other appendages attached inside the hood shall not be required to be welded or brazed but shall be otherwise sealed to be grease tight.

Exceptions:

1. Penetrations shall not be required to be welded or brazed where sealed by devices that are *listed* for the application.
2. Internal welding or brazing of seams, joints and penetrations of the hood shall not be prohibited provided that the joint is formed smooth or ground so as to not trap grease, and is readily cleanable.

507.2.6 Clearances for Type I hood. A Type I hood shall be installed with a *clearance* to combustibles of not less than 18 inches (457 mm).

Exceptions:

1. *Clearance* shall not be required from gypsum wallboard or 1/2-inch (12.7 mm) or thicker cementitious wallboard attached to noncombustible structures provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum or cementitious wallboard over an area extending not less than 18 inches (457 mm) in all directions from the hood.

Interpretation: Gypsum wallboard installed on a combustible substrate or on wood studs does not cause the wall to be considered a noncombustible assembly, and the 18 inch minimum *clearance* still applies. The classification of combustible and noncombustible materials is not changed by the use of fire-retardant-treated wood products or fire rated (Type "X") gypsum wallboard.

2. Type I hoods *listed* and *labeled* for *clearances* less than 18 inches (457 mm) in accordance with UL 710 shall be installed with the *clearances* specified by such listings.

507.2.7 Type I hoods penetrating a ceiling. Type I hoods or portions thereof penetrating a ceiling, wall or furred space shall comply with Section 506.3.11. Field-applied grease duct enclosure systems, as addressed in Section 506.3.11.2, shall not be utilized to satisfy the requirements of this section.

Exception: The exhaust hood may penetrate the plane of the adjacent ceiling without a rated enclosure when the ceiling is a minimum of 18" from the hood and the area above the ceiling is separated from a plenum.

507.2.8 Type I grease filters. Type I hoods shall be equipped with grease filters *listed* and *labeled* in accordance with UL 1046. Grease filters shall be provided with access for cleaning or replacement. The lowest edge of a grease filter located above the cooking surface shall be not less than the height specified in Table 507.2.8.

TABLE 507.2.8
MINIMUM DISTANCE BETWEEN THE LOWEST EDGE OF A GREASE FILTER AND THE COOKING SURFACE OR THE HEATING SURFACE

TYPE OF COOKING APPLIANCES	HEIGHT ABOVE COOKING SURFACE (feet)
Without exposed flame	0.5
Exposed flame and burners	2
Exposed charcoal and charbroil type	3.5

For SI: 1 foot = 304.8 mm.

507.2.8.1 Criteria. Filters shall be of such size, type and arrangement as will permit the required quantity of air to pass through such units at rates not exceeding those for which the filter or unit was designed or *approved*. Filter units shall be installed in frames or holders so as to be readily removable without the use of separate tools, unless designed and installed to be cleaned in place and the system is equipped for such cleaning in place. Where filters are designed and required to be cleaned, removable filter units shall be of a size that will allow them to be cleaned in a dishwashing machine or pot sink. Filter units shall be arranged in place or provided with drip-intercepting devices to prevent grease or other condensate from dripping into food or on food preparation surfaces.

507.2.8.2 Mounting position of grease filters. Filters shall be installed at an angle of not less than 45 degrees (0.79 rad) from the horizontal and shall be equipped with a drip tray beneath the lower edge of the filters.

507.2.9 Grease gutters for Type I hood. Grease gutters shall drain to an *approved* collection receptacle that is fabricated, designed and installed to allow access for cleaning.

[S] 507.3 Type II hoods. Type II hoods shall be installed ((~~above~~)) for collecting and removing steam, vapor, heat or odors from dishwashers and *appliances* that produce heat or moisture and do not produce grease or smoke as a result of the cooking process, except where the heat and moisture loads from such *appliances* are incorporated into the HVAC system design or into the design of a separate removal system. Type II hoods shall be installed ((~~above~~)) for collecting and removing steam, vapor, heat or odors from all *appliances* that produce products of combustion and do not produce grease or smoke as a result of the cooking process. Spaces containing cooking *appliances* that do not require Type II hoods shall be provided with exhaust at a rate of 0.70 cfm per square foot (0.00356 $m^3/(s \cdot m^2)$. For the purpose of determining the floor area required to be exhausted, each individual *appliance* that is not required to be installed under a Type II hood shall be considered as occupying not less than 100 square feet (9.3 m^2). Such additional square footage shall be provided with exhaust at a rate of 0.70 cfm per square foot [0.00356 $m^3/(s \cdot m^2)$].

507.3.1 Type II hood materials. Type II hoods shall be constructed of steel having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage) or stainless steel not less than 0.0220 inch (0.5550 mm) (No. 24 gage) in thickness, copper sheets weighing not less than 24 ounces per square foot (7.3 kg/m^2) or of other *approved* material and gage.

507.3.2 Type II supports. Type II hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading and the possible weight of personnel working in or on the hood.

507.3.3 Type II hoods joint, seams and penetrations. Joints, seams and penetrations for Type II hoods shall be constructed as set forth in Chapter 6, shall be sealed on the interior of the hood and shall provide a smooth surface that is readily cleanable and watertight.

507.4 Hood size and location. Hoods shall comply with the overhang, setback and height requirements in accordance with Sections 507.4.1 and 507.4.2, based on the type of hood.

507.4.1 Canopy size and location. The inside lower edge of canopy-type Type I and II commercial hoods shall overhang or extend a horizontal distance of not less than 6 inches (152 mm) beyond the edge of the top horizontal surface of the *appliance* on all open sides. The vertical distance between the front lower lip of the hood and such surface shall not exceed 4 feet (1219 mm).

Exception: The hood shall be permitted to be flush with the outer edge of the cooking surface where the hood is closed to the *appliance* side by a noncombustible wall or panel.

507.4.2 Noncanopy size and location. Noncanopy-type hoods shall be located not greater than 3 feet (914 mm) above the cooking surface. The edge of the hood shall be set back not greater than 1 foot (305 mm) from the edge of the cooking surface.

507.5 Capacity of hoods. Commercial food service hoods shall exhaust a minimum net quantity of air determined in accordance with this section and Sections 507.5.1 through 507.5.5. The net quantity of *exhaust air* shall be calculated by subtracting any airflow supplied directly to a hood cavity from the total exhaust flow rate of a hood. Where any combination of *heavy-duty, medium-duty* and *light-duty cooking appliances* are utilized under a single hood, the exhaust rate required by this section for the heaviest duty *appliance* covered by the hood shall be used for the entire hood.

[S] 507.5.1 Extra-heavy-duty (solid fuel) cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *extra-heavy-duty cooking appliances* shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	Not allowed
Double island canopy (per side)	550
Eyebrow	Not allowed
Single island canopy	700
Wall-mounted canopy	550

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.5.2 Heavy-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *heavy-duty cooking appliances* shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	400
Double island canopy (per side)	400
Eyebrow	Not allowed
Single island canopy	600
Wall-mounted canopy	400

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.5.3 Medium-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *medium-duty cooking appliances* shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	300
Double island canopy (per side)	300
Eyebrow	250
Single island canopy	500
Wall-mounted canopy	300

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.5.4 Light-duty cooking appliances. The minimum net airflow for hoods, as determined by Section 507.1, used for *light-duty* cooking *appliances* and food service preparation shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	250
Double island canopy (per side)	250
Eyebrow	250
Single island canopy	400
Wall-mounted canopy	200

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.5.5 Dishwashing appliances. The minimum net airflow for Type II hoods used for dishwashing *appliances* shall be 100 cfm per linear foot (155 L/s per linear meter) of hood length.

Exception: Dishwashing *appliances* and *equipment* installed in accordance with Section 507.3.

507.6 Performance test. A performance test shall be conducted upon completion and before final approval of the installation of a ventilation system serving *commercial cooking appliances*. The test shall verify the rate of exhaust airflow required by

Section 507.5, makeup airflow required by Section 508 and proper operation as specified in this chapter. The permit holder shall furnish the necessary test *equipment* and devices required to perform the tests.

507.6.1 Capture and containment test. The permit holder shall verify capture and containment performance of the exhaust system. This field test shall be conducted with all *appliances* under the hood at operating temperatures, with all sources of outdoor air providing *makeup air* for the hood operating and with all sources of recirculated air providing conditioning for the space in which the hood is located operating. Capture and containment shall be verified visually by observing smoke or steam produced by actual or simulated cooking, such as that provided by smoke generators.

SECTION 508
COMMERCIAL KITCHEN MAKEUP AIR

[S] 508.1 Makeup air. *Makeup air* shall be supplied during the operation of commercial kitchen exhaust systems that are provided for *commercial cooking appliances*. ((~~The amount of *makeup air* supplied to the building from all sources shall be approximately equal to the amount of *exhaust air* for all exhaust systems for the building.~~)) A separate *makeup air* system for the kitchen shall be capable of providing not less than 90 percent of the air to be exhausted. The *makeup air* shall not reduce the effectiveness of the exhaust system. *Makeup air* shall be provided by gravity or mechanical means or both. Mechanical *makeup air* systems shall be automatically controlled to start and operate simultaneously with the exhaust system. Exterior windows and doors shall not be used to provide commercial kitchen *makeup air*. *Makeup air* intake opening locations shall comply with Section 401.4.

Note: Refer to Section C403.7.7 of the *Seattle Energy Code* in addition to the requirements of this section.

Exceptions:

1. Where the total airflow for the exhaust system is less than 400 cfm, *makeup air* is not required; or
2. In atriums, food courts, and similar areas, occupant *ventilation air* that would otherwise exfiltrate or be exhausted by other mechanical exhaust systems may be used to provide all *makeup air*, or a portion of *makeup air* when a direct path through permanent openings exists for occupant *ventilation air* to transfer to the kitchen hood area. That portion of air not supplied by occupant *ventilation air* shall be provided by a separate *makeup air* system. The combined air quantity provided by a separate *makeup air* system and occupant *ventilation air* shall provide 100 percent of the air to be exhausted.

508.1.1 Makeup air temperature. The temperature differential between *makeup air* and the air in the conditioned space shall not exceed 10ºF (6ºC) if the amount of *makeup air* supply exceeds 2,500 cfm (1180 L/s) per space except where the added heating and cooling loads of the *makeup air* do not exceed the capacity of the HVAC system.

508.1.2 Air balance. Design plans for a facility with a commercial kitchen ventilation system shall include a schedule or diagram indicating the design outdoor air balance. The design outdoor air balance shall indicate all exhaust and replacement air for the facility, plus the net exfiltration if applicable. The total replacement air airflow rate shall equal the total exhaust airflow rate plus the net exfiltration.

508.2 Compensating hoods. Manufacturers of compensating hoods shall provide a label indicating the minimum exhaust flow, the maximum makeup airflow or both that provides capture and containment of the exhaust effluent.

Exception: Compensating hoods with *makeup air* supplied only from the front face discharge and side face discharge openings shall not be required to be labeled with the maximum makeup airflow.

SECTION 509
FIRE SUPPRESSION SYSTEMS

509.1 Where required. *Cooking appliances* required by Section 507.2 to have a Type I hood shall be provided with an *approved* automatic fire suppression system complying with the *International Building Code* and the *International Fire Code*.

SECTION 510
HAZARDOUS EXHAUST SYSTEMS

510.1 General. This section shall govern the design and construction of duct systems for hazardous exhaust and shall determine where such systems are required. Hazardous exhaust systems are systems designed to capture and control hazardous emissions generated from product handling or processes, and convey those emissions to the outdoors. Hazardous emissions include flammable vapors, gases, fumes, mists or dusts, and volatile or airborne materials posing a health hazard, such as toxic or corrosive materials. For the purposes of this section, the health-hazard rating of materials shall be as specified in NFPA 704.

For the purposes of the provisions of Section 510, a laboratory shall be defined as a facility where the use of chemicals is related to testing, analysis, teaching, research or developmental activities. Chemicals are used or synthesized on a nonproduction basis, rather than in a manufacturing process.

[S] 510.2 Where required. A hazardous exhaust system shall be required wherever operations involving the handling or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create one of the following conditions:

1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25 percent of the lower flammability limit of the substance for the expected room temperature.
2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration.
3. A vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2 or 3 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

~~((**Exception:** Laboratories, as defined in Section 510.1, except where the concentrations listed in Item 1 are exceeded or a vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2, 3 or 4 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.))~~

In lieu of complying with this section, research and educational laboratories are permitted to comply with rules adopted by the Director for laboratory exhaust systems for hazardous materials.

Note: See Director's Rule 30-2005 for provisions on ventilation systems in research and educational laboratories.

[F] 510.2.1 Lumber yards and woodworking facilities. *Equipment* or machinery located inside buildings at lumber yards and woodworking facilities that generates or emits combustible dust shall be provided with an *approved* dust-collection and exhaust system installed in accordance with this section and the *International Fire Code*. *Equipment* and systems that are used to collect, process or convey combustible dusts shall be provided with an *approved* explosion-control system.

[F] 510.2.2 Combustible fibers. *Equipment* or machinery within a building that generates or emits combustible fibers shall be provided with an *approved* dust-collecting and exhaust system. Such systems shall comply with this code and the *International Fire Code*.

[S] 510.2.3 Model shops and other intermittent use facilities. *Equipment* or machinery located inside buildings that emit dust but are used on an intermittent basis, such as in model shops, research and development facilities, hobby, and other non-production uses, shall be provided with a local, point of use dust collection system. The dust collector is permitted to be a portable type with high efficiency filters to allow *exhaust air* to be discharged back into the space. Such collectors are not required to be provided with an *approved* explosion-control system. Such systems shall be limited to an aggregate airflow of no more than 1,500 cfm per room.

510.3 Design and operation. The design and operation of the exhaust system shall be such that flammable contaminants are diluted in noncontaminated air to maintain concentrations in the exhaust flow below 25 percent of the contaminant's lower flammability limit.

510.4 Incompatible materials and common shafts. Incompatible materials, as defined in the *International Fire Code*, shall not be exhausted through the same hazardous exhaust system. Hazardous exhaust systems shall not share common shafts with other duct systems, except where such systems are hazardous exhaust systems originating in the same fire area.

Exception: The provisions of this section shall not apply to laboratory exhaust systems where all of the following conditions apply:

1. All of the hazardous exhaust ductwork and other laboratory exhaust within both the occupied space and the shafts are under negative pressure while in operation.
2. The hazardous exhaust ductwork manifolded together within the occupied space must originate within the same fire area.
3. Hazardous exhaust ductwork originating in different fire areas and manifolded together in a common shaft shall meet the provisions of Section 717.5.3, Exception 1, Item 1.1 of the *International Building Code*.
4. Each control branch has a flow-regulating device.
5. Perchloric acid hoods and connected exhaust shall be prohibited from manifolding.
6. Radioisotope hoods are equipped with filtration, carbon beds or both where required by the *registered design professional*.
7. Biological safety cabinets are filtered.
8. Each hazardous exhaust duct system shall be served by redundant exhaust fans that comply with either of the following:

8.1. The fans shall operate simultaneously in parallel and each fan shall be individually capable of providing the required exhaust rate.

8.2. Each of the redundant fans is controlled so as to operate when the other fan has failed or is shut down for servicing.

510.5 Design. Systems for removal of vapors, gases and smoke shall be designed by the constant velocity or equal friction methods. Systems conveying particulate matter shall be designed employing the constant velocity method.

510.5.1 Balancing. Systems conveying explosive or radioactive materials shall be prebalanced by duct sizing. Other systems shall be balanced by duct sizing with balancing devices, such as dampers. Dampers provided to balance airflow shall have securely fixed minimum-position blocking devices to prevent restricting the flow below the required volume or velocity.

510.5.2 Emission control. The design of the system shall be such that the emissions are confined to the area in which they are generated by air currents, hoods or enclosures and shall be exhausted by a duct system to a safe location or treated by removing contaminants.

510.5.3 Hoods required. Hoods or enclosures shall be used where contaminants originate in a limited area of a space. The design of the hood or enclosure shall be such that air currents created by the exhaust systems will capture the contaminants and transport them directly to the exhaust duct.

510.5.4 Contaminant capture and dilution. The velocity and circulation of air in work areas shall be such that contaminants are captured by an airstream at the area where the emissions are generated and conveyed into a product-conveying duct system. Contaminated air from work areas where hazardous contaminants are generated shall be diluted below the thresholds specified in Section 510.2 with air that does not contain other hazardous contaminants.

510.5.5 Makeup air. *Makeup air* from all sources shall be provided during operations at a rate approximately equal to the rate that air is exhausted by the hazardous exhaust system. *Makeup air* shall be provided by gravity or mechanical means or both. Mechanical *makeup air* systems shall be automatically controlled to start and operate simultaneously with the exhaust system. The *makeup air* shall not reduce the effectiveness of the exhaust system. *Makeup air* intakes shall be located in accordance with Section 401.4.

510.5.6 Clearances. The minimum *clearance* between hoods and combustible construction shall be the *clearance* required by the duct system.

510.5.7 Ducts. Hazardous exhaust duct systems shall extend directly to the exterior of the building and shall not extend into or through ducts and *plenums*.

510.6 Penetrations. Penetrations of structural elements by a hazardous exhaust system shall conform to Sections 510.6.1 through 510.6.4.

Exception: Duct penetrations within Group H-5 *occupancies* as allowed by the *International Building Code*.

510.6.1 Fire dampers and smoke dampers. Fire dampers and smoke dampers are prohibited in hazardous exhaust ducts.

510.6.1.1 Shaft penetrations. Hazardous exhaust ducts that penetrate fire-resistance-rated shafts shall comply with Section 714.4.1 or 714.4.1.2 of the *International Building Code*.

510.6.2 Floors. Hazardous exhaust systems that penetrate a floor/ceiling assembly shall be enclosed in a fire-resistance-rated shaft constructed in accordance with the *International Building Code*.

510.6.3 Wall assemblies. Hazardous exhaust duct systems that penetrate fire-resistance-rated wall assemblies shall be enclosed in fire-resistance-rated construction from the point of penetration to the outlet terminal, except where the interior of the duct is equipped with an approved automatic fire suppression system. Ducts shall be enclosed in accordance with the *International Building Code* requirements for shaft construction and such enclosure shall have a minimum fire-resistance rating of not less than the highest fire-resistance-rated wall assembly penetrated.

510.6.4 Fire walls. Ducts shall not penetrate a fire wall.

510.7 Suppression required.

[S] 510.7.1 Ducts. Ducts shall be protected with an *approved* automatic fire suppression system installed in accordance with the *International Building Code*.

Exceptions:

1. An approved automatic fire suppression system shall not be required in ducts conveying materials, fumes, mists and vapors that are nonflammable and noncombustible under all conditions and at any concentrations.
2. Automatic fire suppression systems shall not be required in metallic and noncombustible, non-metallic exhaust ducts in semiconductor fabrication facilities.

3. An *approved* automatic fire suppression system shall not be required in ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).
4. For laboratories, as defined in Section 510.1, automatic fire protection systems shall not be required ((~~in~~)) for metallic ducts that serve laboratory hoods or exhaust systems.
5. An *approved* automatic fire suppression system is not required in metallic ducts serving fume hoods if all fume hoods served by the duct are equipped with an *approved* fire suppression system.

((~~510.7.1~~)) 510.7.2 Duct cleanout. Ducts conveying combustible dust as part of a dust collection system shall be equipped with cleanouts that are provided with approved access, predesigned to be disassembled for cleaning, or engineered for automatic cleanouts. Where provided, cleanouts shall be located at the base of each vertical duct riser and at intervals not exceeding 20 feet (6096 mm) in horizontal sections of duct.

[S] 510.7.3 Fume hoods. *Approved* automatic fire suppression shall be installed in fume hoods within which operations are conducted involving hazardous materials that have the potential to create a flammable vapor, gas, fume, mist, or dust in concentrations exceeding 25 percent of the lower flammability limit of the substance or mixture for the expected room temperature in the absence of the fume hood and under normal operating conditions.

510.8 Duct construction. Ducts used to convey hazardous exhaust shall be constructed of materials *approved* for installation in such an exhaust system and shall comply with one of the following:

1. Ducts shall be constructed of *approved* G90 galvanized sheet steel, with a minimum nominal thickness as specified in Table 510.8.
2. Ducts used in systems exhausting nonflammable corrosive fumes or vapors shall be constructed of nonmetallic materials that exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 or UL 723 and that are *listed* and *labeled* for the application.

Where the products being exhausted are detrimental to the duct material, the ducts shall be constructed of alternative materials that are compatible with the exhaust.

TABLE 510.8
MINIMUM DUCT THICKNESS

DIAMETER OF DUCT OR MAXIMUM SIDE DIMENSION	MINIMUM NOMINAL THICKNESS		
	Nonabrasive materials	Nonabrasive/abrasive materials	Abrasive materials
0–8 inches	0.028 inch (No. 24 gage)	0.034 inch (No. 22 gage)	0.040 inch (No. 20 gage)
9–18 inches	0.034 inch (No. 22 gage)	0.040 inch (No. 20 gage)	0.052 inch (No. 18 gage)
19–30 inches	0.040 inch (No. 20 gage)	0.052 inch (No. 18 gage)	0.064 inch (No. 16 gage)
Over 30 inches	0.052 inch (No. 18 gage)	0.064 inch (No. 16 gage)	0.079 inch (No. 14 gage)

For SI: 1 inch = 25.4 mm.

510.8.1 Duct joints. Ducts shall be made tight with lap joints having a minimum lap of 1 inch (25 mm). Joints used in ANSI/SMACNA Round Industrial Duct Construction Standards and ANSI/SMACNA Rectangular Industrial Duct Construction Standards are also acceptable.

510.8.2 Clearance to combustibles. Ducts shall have a *clearance* to combustibles in accordance with Table 510.8.2. Exhaust gases having temperatures in excess of 600ºF (316ºC) shall be exhausted to a *chimney* in accordance with Section 511.2.

TABLE 510.8.2
CLEARANCE TO COMBUSTIBLES

TYPE OF EXHAUST OR TEMPERATURE OF EXHAUST (°F)	CLEARANCE TO COMBUSTIBLES (inches)
Less than 100	1
100–600	12
Flammable vapors	6

For SI: 1 inch = 25.4 mm, °C = [(°F) – 32]/1.8.

510.8.3 Explosion relief. Systems exhausting potentially explosive mixtures shall be protected with an *approved* explosion relief system or by an *approved* explosion prevention system designed and installed in accordance with NFPA 69. An explosion relief system shall be designed to minimize the structural and mechanical damage resulting from an explosion or

deflagration within the exhaust system. An explosion prevention system shall be designed to prevent an explosion or deflagration from occurring.

510.9 Supports. Ducts shall be supported at intervals not exceeding 10 feet (3048 mm). Supports shall be constructed of noncombustible material.

SECTION 511
DUST, STOCK AND REFUSE CONVEYING SYSTEMS

511.1 Dust, stock and refuse conveying systems. Dust, stock and refuse conveying systems shall comply with the provisions of Section 510, Sections 511.1.1 through 511.2 and the *International Fire Code*.

[S] 511.1.1 Collectors and separators. Collectors and separators involving such systems as centrifugal separators, bag filter systems and similar devices, and associated supports shall be constructed of noncombustible materials and shall be located on the exterior of the building or structure. A collector or separator shall not be located nearer than 10 feet (3048 mm) to combustible construction or to an unprotected wall or floor opening, unless the collector is provided with a metal vent pipe that extends above the highest part of any roof with a distance of 30 feet (9144 mm).

Exceptions:

1. Collectors such as "Point of Use" collectors, close extraction weld fume collectors, spray finishing booths, stationary grinding tables, sanding booths, and integrated or machine-mounted collectors shall be permitted to be installed indoors provided that the installation is in accordance with the *International Fire Code* and NFPA 70.
2. Collectors in independent exhaust systems handling combustible dusts shall be permitted to be installed indoors provided that such collectors are installed in compliance with the *International Fire Code* and ((~~NFPA 70~~)) the *Seattle Electrical Code*.

511.1.2 Discharge pipe. Discharge piping shall conform to the requirements for ducts, including clearances required for high-heat *appliances*, as contained in this code. A delivery pipe from a cyclone collector shall not convey refuse directly into the firebox of a boiler, furnace, Dutch oven, refuse burner, incinerator or other *appliance*.

511.1.3 Conveying systems exhaust discharge. An exhaust system shall discharge to the outside of the building either directly by flue or indirectly through the bin or vault into which the system discharges except where the contaminants have been removed. Exhaust system discharge shall be permitted to be recirculated provided that the solid particulate has been removed at a minimum efficiency of 99.9 percent at 10 microns (10.01 mm), vapor concentrations are less than 25 percent of the LFL, and *approved equipment* is used to monitor the vapor concentration.

511.1.4 Spark protection. The outlet of an open-air exhaust terminal shall be protected with an *approved* metal or other noncombustible screen to prevent the entry of sparks.

511.1.5 Explosion control. Explosion control shall be provided in accordance with the requirements of the *International Fire Code* on all systems that convey combustible dust or combustible refuse or stock that produces combustible dusts in such a manner that the concentration and conditions could create a fire or explosion hazard. Determination of concentrations or conditions that are deemed to not create a fire or explosion hazard shall be based on a Dust Hazard Analysis prepared in accordance with Section 2203.2 of the *International Fire Code*.

511.1.5.1 Screens. Where a screen is installed in a safety relief vent, the screen shall be attached so as to permit ready release under the explosion pressure.

511.1.5.2 Hoods. The relief vent shall be provided with an *approved* noncombustible cowl or hood, or with a counterbalanced relief valve or cover arranged to prevent the escape of hazardous materials, gases or liquids.

511.2 Exhaust outlets. Outlets for exhaust that exceed 600ºF (315ºC) shall be designed as a *chimney* in accordance with Table 511.2.

TABLE 511.2
CONSTRUCTION, CLEARANCE AND TERMINATION REQUIREMENTS FOR SINGLE-WALL METAL CHIMNEYS

CHIMNEYS SERVING	MINIMUM THICKNESS		TERMINATION				CLEARANCE			
	Walls (inch)	Lining	Above roof opening (feet)	Above any part of building within (feet)			Combustible construction (inches)		Noncombustible construction	
				10	25	50	Interior inst.	Exterior inst.	Interior inst.	Exterior inst.
High-heat appliances (Over 2,000°F)[a]	0.127 (No. 10 MSG)	4-1/2″ laid on 4-1/2″ bed	20	—	—	20	See Note c			

CHIMNEYS SERVING	MINIMUM THICKNESS		TERMINATION				CLEARANCE			
	Walls (inch)	Lining	Above roof opening (feet)	Above any part of building within (feet)			Combustible construction (inches)		Noncombustible construction	
				10	25	50	Interior inst.	Exterior inst.	Interior inst.	Exterior inst.
Low-heat appliances (1,000°F normal operation)	0.127 (No. 10 MSG)	None	3	2	—	—	18	6	Up to 18″ diameter, 2″ Over 18″ diameter, 4″	
Medium-heat appliances (2,000°F maximum)[b]	0.127 (No. 10 MSG)	Up to 18″ dia.—2-1/2″ Over 18″—4-1/2″ on 4-1/2″ bed	10	—	10	—	36	24		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F) – 32]/1.8.
a. Lining shall extend from bottom to top of outlet.
b. Lining shall extend from 24 inches below connector to 24 feet above.
c. Clearance shall be as specified by the design engineer and shall have sufficient clearance from buildings and structures to avoid overheating combustible materials (maximum 160°F).

SECTION 512
SUBSLAB SOIL EXHAUST SYSTEMS

512.1 General. Where a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.

[S] 512.2 Materials. Subslab soil exhaust system duct material shall be air duct material *listed* and *labeled* to the requirements of UL 181 for Class 0 air ducts, or any of the following piping materials that comply with the ((~~*International*~~)) Uniform *Plumbing Code* as building sanitary drainage and vent pipe: cast iron; galvanized steel; copper or copper-alloy pipe and tube of a weight not less than type DWV; and plastic piping.

512.3 Grade. Exhaust system ducts shall not be trapped and shall have a minimum slope of 1/8 unit vertical in 12 units horizontal (1-percent slope).

512.4 Termination. Subslab soil exhaust system ducts shall extend through the roof and terminate not less than 6 inches (152 mm) above the roof and not less than 10 feet (3048 mm) from any operable openings or air intake.

512.5 Identification. Subslab soil exhaust ducts shall be permanently identified within each floor level by means of a tag, stencil or other *approved* marking.

SECTION 513
SMOKE CONTROL SYSTEMS

[F] 513.1 Scope and purpose. This section applies to mechanical and passive smoke control systems that are required by the *International Building Code* or the *International Fire Code*. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations, or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke and heat removal provisions found in Section 910 of the *International Building Code* or the *International Fire Code*.

[F] 513.2 General design requirements. Buildings, structures, or parts thereof required by the *International Building Code* or the *International Fire Code* to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 of the *International Building Code* and the generally accepted and well-established principles of engineering relevant to the design. The *construction documents* shall include sufficient information and detail to describe adequately the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied with sufficient information and analysis to demonstrate compliance with these provisions.

[F] 513.3 Special inspection and test requirements. In addition to the ordinary inspection and test requirements that buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 of the *International Building Code* shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the *construction documents* shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the

particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms as found in Section 1704 of the *International Building Code*.

Note: See Seattle Fire Department (SFD) Administrative Rule 9.02.19.

[F] 513.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted *construction documents* and shall include, but not be limited to, the items indicated in Sections 513.4.1 through 513.4.7.

[F] 513.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effects will not adversely interfere with the system's capabilities. In determining the maximum probable stack effects, altitude, elevation, weather history and interior temperatures shall be used.

[F] 513.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 513.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with its capabilities.

[F] 513.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of the *International Building Code*.

[F] 513.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems' status. The design shall consider the effects of fire on the HVAC systems.

[F] 513.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

[F] 513.4.6 Duration of operation. All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

[F] 513.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

[S][F] 513.5 Smoke barrier construction. Smoke barriers required for ((~~passive~~)) engineered smoke control and a smoke control system using the pressurization method shall comply with Section 709 of the *International Building Code*. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls: $A/A_w = 0.00100$
2. Interior exit stairways and ramps and exit passageways: $A/A_w = 0.00035$
3. Enclosed exit access stairways and ramps and all other shafts: $A/A_w = 0.00150$
4. Floors and roofs: $A/A_F = 0.00050$

where:

A = Total leakage area, square feet (m^2).

A_F = Unit floor or roof area of barrier, square feet (m^2).

A_w = Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings created by gaps around doors and operable windows. The total leakage area of the smoke barrier shall be determined in accordance with Section 513.5.1 and tested in accordance with Section 513.5.2.

[F] 513.5.1 Total leakage area. Total leakage area of the barrier is the product of the smoke barrier gross area times the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

[F] 513.5.2 Testing of leakage area. Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as *approved* by the fire code official.

[F] 513.5.3 Opening protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by door assemblies complying with the requirements of the *International Building Code* for doors in smoke barriers.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors *listed* for releasing service installed in accordance with the *International Building Code*.

[S][F] 513.11 ((~~Standby~~)) Emergency power. The smoke control system shall be supplied with ((~~standby~~)) emergency power in accordance with Section 2702 of the *International Building Code*.

[F] 513.11.1 Equipment room. The ((~~standby~~)) emergency power source and its transfer switches shall be in a room separate from the normal power transformers and switch gear and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire-resistance-rated fire barriers constructed in accordance with Section 707 of the *International Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *International Building Code,* or both.

[F] 513.11.2 Power sources and power surges. Elements of the smoke management system relying on volatile memories or the like shall be supplied with uninterruptible power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other *approved* means.

[F] 513.11.3 Wiring. In addition to meeting requirements of the *Seattle Electrical Code*, all wiring regardless of voltage, shall have fire-resistance-rated protection of at least two hours or as required in rules promulgated by the *code official*.

Exception: Subject to the approval of the *code official*, fire-resistance-rating is not required for wiring located in a parking garage.

[F] 513.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907 of the *International Building Code*. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control *equipment*.

[F] 513.12.1 Verification. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, *equipment* and components used for smoke control.

Exception: Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing, where *approved* by the building official and in accordance with both of the following:

1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit.
2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section 909.20.6 of the *International Fire Code*.

[S][F] 513.12.2 Wiring. ((~~In addition to meeting the requirements of NFPA 70, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.~~)) See Section 513.11.

[F] 513.12.3 Activation. Smoke control systems shall be activated in accordance with the *International Building Code* or the *International Fire Code*.

[S][F] 513.12.4 Automatic control. Where complete automatic control is required or used, the automatic control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1 of the *International Fire Code*, from manual controls provided with *ready access* for the fire department, and any smoke detectors ((~~required by engineering analysis~~)) in the building.

[F] 513.13 Control-air tubing. Control-air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections. Tubing shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

[F] 513.13.1 Materials. Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B42, ASTM B43, ASTM B68, ASTM B88, ASTM B251 and ASTM B280. Fittings shall be wrought copper or copper alloy, solder type in accordance with ASME B16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Copper-alloy compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solidus above 1,100ºF (593ºC) and liquidus below 1,500ºF (816ºC). Brazing flux shall be used on copper-to-copper alloy joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices provided that all of the following conditions are met:

1. Tubing shall comply with the requirements of Section 602.2.1.3.
2. Tubing and connected device shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by

copper tubing with a protective grommet of Neoprene or Teflon or by suitable brass compression to male barbed adapter.

3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or movable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing connected to devices on doors shall be fastened along hinges.

[F] 513.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

[F] 513.13.3 Testing. Control-air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

[F] 513.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

[F] 513.15 Control diagrams. Identical control diagrams shall be provided and maintained as required by the *International Fire Code*.

[F] 513.16 Fire fighter's smoke control panel. A fire fighter's smoke control panel for fire department emergency response purposes only shall be provided in accordance with the *International Fire Code*.

[F] 513.17 System response time. Smoke control system activation shall comply with the *International Fire Code*.

[F] 513.18 Acceptance testing. Devices, *equipment*, components and sequences shall be tested in accordance with the *International Fire Code*.

[F] 513.19 System acceptance. Acceptance of the smoke control system shall be in accordance with the *International Fire Code*.

SECTION 514
ENERGY RECOVERY VENTILATION SYSTEMS

514.1 General. Energy recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy recovery ventilation systems shall comply with the *International Energy Conservation Code*. Ducted heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1812. Nonducted heat recovery ventilators shall be *listed* and *labeled* in accordance with UL 1815.

514.2 Prohibited applications. Energy recovery ventilation systems shall not be used in the following systems:

1. Hazardous exhaust systems covered in Section 510.
2. Dust, stock and refuse systems that convey explosive or flammable vapors, fumes or dust.
3. Smoke control systems covered in Section 513.
4. Commercial kitchen exhaust systems serving Type I hoods.
5. Clothes dryer exhaust systems covered in Section 504.

Exception: The application of ERV *equipment* that recovers sensible heat only utilizing coil-type heat exchangers shall not be limited by this section.

514.3 Access. A means of access shall be provided to the heat exchanger and other components of the system as required for service, maintenance, repair or replacement.

514.4 Recirculated air. Air conveyed within energy recovery systems shall not be considered as recirculated air where the energy recovery ventilation system is constructed to limit cross-leakage between air streams to less than 10 percent of the total airflow design capacity.

[S] SECTION 515
WASTE OR LINEN CHUTE VENTING

[S] 515.1 Chute venting and roof termination. The full diameter of waste and linen chutes shall extend a minimum of 3 feet (0.92 m) above the building roof and be gravity vented per NFPA 82.

Exceptions:

1. Waste and linen chutes are permitted to be mechanically ventilated by an exhaust fan in lieu of gravity venting. The exhaust fan shall be located outside the building at the top of the chute.

2. Where the trash chute does not extend to the highest floor of the building below the roof, the trash chute shall be permitted to vent to a sidewall louver termination by gravity venting or mechanical venting. The horizontal extension of the trash chute shall have the same cross-sectional area as the chute and shall be enclosed in rated construction equal to the rating of the shaft enclosure. No operable openings shall be located within 10 feet of the sidewall louver termination.

CHAPTER 6
DUCT SYSTEMS

User note:

About this chapter: *Chapter 6 addresses duct systems used in HVAC systems and some exhaust systems. Some exhaust system ducts are addressed in Chapter 5, such as kitchen exhaust ducts and clothes dryer exhaust ducts. This chapter addresses air plenums such as above-ceiling and below-floor plenums. Section 607 covers fire and smoke dampers, consistent with the requirements of the* International Building Code®*.*

SECTION 601
GENERAL

601.1 Scope. Duct systems used for the movement of air in air-conditioning, heating, ventilating and exhaust systems shall conform to the provisions of this chapter except as otherwise specified in Chapters 5 and 7.

Exception: Ducts discharging combustible material directly into any *combustion* chamber shall conform to the requirements of NFPA 82.

[W][S][BE] 601.2 Air movement in egress elements. Corridors shall not serve as supply, return, exhaust, relief or *ventilation air* ducts.

Exceptions:

1. Use of a corridor as a source of *makeup air* for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, ((~~smoking lounges~~)) and janitor closets, shall be permitted, provided that each such corridor is directly supplied with ((~~outdoor~~)) air at a rate greater than the rate of *makeup air* taken from the corridor.
2. Where located within a *dwelling unit*, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m^2) or less in area, use of corridors for conveying return air is permitted.
4. Transfer air movement required to maintain pressurization difference within health care facilities in accordance with ASHRAE 170.
5. Where such air is part of an engineered smoke control system.
6. Air supplied to corridors serving residential occupancies shall not be considered as providing ventilation air to the dwelling units and sleeping units subject to the following:
   - 6.1. The air supplied to the corridor is 100 percent outside air; and
   - 6.2. The dwelling units have conforming ventilation air independent of the air supplied to the corridor; and
   - 6.3. For other than high-rise buildings, the supply fan will automatically shut off upon activation of corridor smoke detectors installed in accordance with Section 606.2.4; or
   - 6.4. For high-rise buildings, the supply fan will automatically shut off upon activation of the smoke detectors required by Seattle Fire Code Section 907.2.12.1 or upon receipt of another approved fire alarm signal. The supply fan is not required to be automatically shut off when used as part of an approved building stairwell or elevator hoistway pressurization system. Corridor smoke detectors shall be installed in accordance with Section 606.2.5.

[BE] 601.2.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air *plenum* is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction.
2. The corridor is separated from the *plenum* by fire-resistance-rated construction.
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by this code.
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system.
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an *approved* engineered smoke control system.

SECTION 602
PLENUMS

[S] 602.1 General. Supply, return, exhaust, relief and ventilation air *plenums* shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, mechanical *equipment* rooms and the framing cavities addressed in Section 602.3. *Plenums* shall be limited to one fire area. Air systems that serve multiple *fire areas* shall be ducted from the boundary of the fire area served directly to the air-handling *equipment*. Fuel-fired *appliances* shall not be installed within a *plenum*.

[S] 602.2 Construction. *Plenum* enclosure construction materials that are exposed to the airflow shall comply with the requirements of Section 703.5 of the *International Building Code* or such materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

The use of gypsum boards to form *plenums* shall be limited to systems where the air temperatures do not exceed 125ºF (52ºC) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature as determined by the *registered design professional*. Supply air *plenums* formed by gypsum boards shall not be incorporated in air-handling systems utilizing *direct evaporative cooling* systems.

602.2.1 Materials within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.8, materials within *plenums* shall be noncombustible or shall be *listed* and *labeled* as having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within *plenums* in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials fully enclosed within one of the following:
   - 5.1. Continuous noncombustible raceways or enclosures.
   - 5.2. Approved gypsum board assemblies.
   - 5.3. Materials *listed* and *labeled* for installation within a *plenum* and listed for the application.
6. Materials in Group H, Division 5 fabrication areas and the areas above and below the fabrication area that share a common air recirculation path with the fabrication area.

602.2.1.1 Wiring. Combustible electrical wires and cables and optical fiber cables exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with NFPA 262, or shall be installed in metal raceways or metal sheathed cable. Combustible optical fiber and communication raceways exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.5, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 2024. Only plenum-rated wires and cables shall be installed in plenum-rated raceways.

602.2.1.2 Fire sprinkler piping. Plastic fire sprinkler piping exposed within a *plenum* shall be used only in wet pipe systems and shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 1887.

602.2.1.3 Pneumatic tubing. Combustible pneumatic tubing exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 1820.

602.2.1.4 Electrical equipment in plenums. Electrical *equipment* exposed within a *plenum* shall comply with Sections 602.2.1.4.1 and 602.2.1.4.2.

602.2.1.4.1 Equipment in metallic enclosures. Electrical *equipment* with metallic enclosures exposed within a *plenum* shall be permitted.

602.2.1.4.2 Equipment in combustible enclosures. Electrical *equipment* with combustible enclosures exposed within a *plenum* shall be *listed* and *labeled* for such use in accordance with UL 2043.

602.2.1.5 Discrete plumbing and mechanical products in plenums. Where discrete plumbing and mechanical products and appurtenances are located in a *plenum* and have exposed combustible material, they shall be *listed* and *labeled* for such use in accordance with UL 2043.

SECTION 603
DUCT CONSTRUCTION AND INSTALLATION

603.1 General. An air distribution system shall be designed and installed to supply the required distribution of air. The installation of an air distribution system shall not affect the fire protection requirements specified in the *International Building Code*. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

603.2 Duct sizing. Ducts installed within a single *dwelling unit* shall be sized in accordance with ACCA Manual D, the *appliance* manufacturer's installation instructions or other approved methods. Ducts installed within all other buildings shall be sized in accordance with the ASHRAE *Handbook of Fundamentals* or other equivalent computation procedure.

603.3 Duct classification. Ducts shall be classified based on the maximum operating pressure of the duct at pressures of positive or negative 0.5, 1.0, 2.0, 3.0, 4.0, 6.0 or 10.0 inches (1 inch w.c. = 248.7 Pa) of water column. The pressure classification of ducts shall equal or exceed the design pressure of the air distribution in which the ducts are utilized.

603.4 Metallic ducts. Metallic ducts shall be constructed as specified in the SMACNA *HVAC Duct Construction Standards—Metal and Flexible*.

Exception: Ducts installed within single *dwelling units* shall have a minimum thickness as specified in Table 603.4.

TABLE 603.4
DUCT CONSTRUCTION MINIMUM SHEET METAL THICKNESS FOR SINGLE DWELLING UNITS[a]

ROUND DUCT DIAMETER (inches)	STATIC PRESSURE			
	1/2-inch water gauge		1-inch water gauge	
	Thickness (inches)		Thickness (inches)	
	Galvanized	Aluminum	Galvanized	Aluminum
< 12	0.013	0.018	0.013	0.018
12 to14	0.013	0.018	0.016	0.023
15 to 17	0.016	0.023	0.019	0.027
18	0.016	0.023	0.024	0.034
19 to 20	0.019	0.027	0.024	0.034
RECTANGULAR DUCT DIMENSION (inches)	**STATIC PRESSURE**			
	1/2-inch water gauge		1-inch water gauge	
	Thickness (inches)		Thickness (inches)	
	Galvanized	Aluminum	Galvanized	Aluminum
≤ 8	0.013	0.018	0.013	0.018
9 to 10	0.013	0.018	0.016	0.023
11 to 12	0.016	0.023	0.019	0.027
13 to 16	0.019	0.027	0.019	0.027
17 to 18	0.019	0.027	0.024	0.034
19 to 20	0.024	0.034	0.024	0.034

For SI: 1 inch = 25.4 mm, 1-inch water gauge = 249 Pa.

a. Ductwork that exceeds 20 inches by dimension or exceeds a pressure of 1-inch water gauge shall be constructed in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*.

603.4.1 Minimum fasteners. Round metallic ducts shall be mechanically fastened by means of not less than three sheet metal screws or rivets spaced equally around the joint.

Exception: Where a duct connection is made that is partially inaccessible, three screws or rivets shall be equally spaced on the exposed portion so as to prevent a hinge effect.

603.4.2 Duct lap. Crimp joints for round and oval metal ducts shall be lapped not less than 1 inch (25 mm) and the male end of the duct shall extend into the adjoining duct in the direction of airflow.

603.5 Nonmetallic ducts. Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material and shall comply with UL 181. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards*. The air temperature within nonmetallic ducts shall not exceed 250ºF (121ºC).

[W][S] 603.5.1 Gypsum ducts. The use of gypsum boards to form air shafts (ducts) shall be limited to return air systems where the air temperatures do not exceed 125ºF (52ºC) and the gypsum board surface temperature is maintained above the airstream dew-point temperature as determined by the *registered design professional*. Supply air ducts formed by gypsum boards shall not be incorporated in air-handling systems utilizing *direct evaporative cooling* systems.

Exceptions:

1. Gypsum boards are permitted for ducts that are only used for stairway or elevator pressurization supply or relief air. The gypsum duct shall not attach directly to the *equipment*.
2. Gypsum boards coated on the inside with epoxy paint or foil-facing may be used for ventilation systems serving parking garages.
3. Gypsum boards coated on the inside with epoxy paint or foil-facing may be used for *exhaust air* ducts.

Note: Gypsum ducts shall be sealed in accordance with *Seattle Energy Code* Section C403.10.1.1.

603.5.2 Phenolic ducts. Nonmetallic phenolic ducts shall be constructed and installed in accordance with the SMACNA *Phenolic Duct Construction Standards*.

603.6 Flexible air ducts and flexible air connectors. Flexible air ducts, both metallic and nonmetallic, shall comply with Sections 603.6.1, 603.6.1.1, 603.6.3 and 603.6.4. Flexible air connectors, both metallic and nonmetallic, shall comply with Sections 603.6.2 through 603.6.4.

603.6.1 Flexible air ducts. Flexible air ducts, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such ducts shall be *listed* and *labeled* as Class 0 or Class 1 flexible air ducts and shall be installed in accordance with Section 304.1.

603.6.1.1 Duct length. Flexible air ducts shall not be limited in length.

603.6.2 Flexible air connectors. Flexible air connectors, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such connectors shall be *listed* and *labeled* as Class 0 or Class 1 flexible air connectors and shall be installed in accordance with Section 304.1.

603.6.2.1 Connector length. Flexible air connectors shall be limited in length to 14 feet (4267 mm).

603.6.2.2 Connector penetration limitations. Flexible air connectors shall not pass through any wall, floor or ceiling.

603.6.3 Air temperature. The design temperature of air to be conveyed in flexible air ducts and flexible air connectors shall be less than 250ºF (121ºC).

603.6.4 Flexible air duct and air connector clearance. Flexible air ducts and air connectors shall be installed with a minimum *clearance* to an *appliance* as specified in the *appliance* manufacturer's installation instructions.

603.7 Rigid duct penetrations. Duct system penetrations of walls, floors, ceilings and roofs and air transfer openings in such building components shall be protected as required by Section 607. Ducts in a private garage that penetrate a wall or ceiling that separates a dwelling from a private garage shall be continuous, shall be constructed of sheet steel having a thickness of not less than 0.0187 inch (0.4712 mm) (No. 26 gage) and shall not have openings into the garage. Fire and smoke dampers are not required in such ducts passing through the wall or ceiling separating a dwelling from a private garage except where required by Chapter 7 of the *International Building Code*.

603.8 Underground ducts. Ducts shall be *approved* for underground installation. Metallic ducts not having an *approved* protective coating shall be completely encased in not less than 2 inches (51 mm) of concrete.

603.8.1 Slope. Ducts shall have a minimum slope of 1/8 inch per foot (10.4 mm/m) to allow drainage to a point provided with access.

603.8.2 Sealing. Ducts shall be sealed, secured and tested prior to concrete encasement or direct burial. Ducts shall be leak tested as required by Section C403 of the *International Energy Conservation Code*.

603.8.3 Plastic ducts and fittings. Plastic ducts shall be constructed of PVC having a minimum pipe stiffness of 8 psi (55 kPa) at 5-percent deflection when tested in accordance with ASTM D2412. Plastic duct fittings shall be constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be utilized in underground installations only. The maximum design temperature for systems utilizing plastic duct and fittings shall be 150°F (66°C).

603.9 Joints, seams and connections. Longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA *HVAC Duct Construction Standards—Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards*. Joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tapes and mastics used to seal fibrous glass ductwork shall be *listed* and *labeled* in accordance with UL 181A and shall be marked "181 A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic. Duct connections to flanges of air distribution system *equipment* shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181 B-C." Closure systems used to seal all ductwork shall be installed in accordance with the manufacturer's instructions.

Exception: For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-lock and button-lock type joints and seams located outside of conditioned spaces.

603.10 Supports. Ducts shall be supported in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's instructions.

[S] 603.10.1 Seismic loads. Bracing for ducts shall be designed to resist seismic loading, using accepted engineering practices and Chapter 16 of the *International Building Code*.

Interpretation: Duct bracing that complies with the SMACNA guideline "Seismic Restraint Manual Guidelines for Mechanical Systems" is deemed to comply with Section 603.10 and the *International Building Code*.

603.11 Furnace connections. Ducts connecting to a furnace shall have a *clearance* to combustibles in accordance with the furnace manufacturer's installation instructions.

603.12 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

[BS] 603.13 Flood hazard areas. For structures in flood hazard areas, ducts shall be located above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the ducts during floods up to such elevation. If the ducts are located below the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment, the ducts shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

[S] 603.14 Location. Ducts shall not be installed in or within 4 inches (102 mm) of the earth, except where such ducts comply with Section 603.8. Ducts installed in parking garages shall provide a clear floor height of not less than 6 feet 6 inches at the vehicle and pedestrian traffic areas, except where a minimum vertical *clearance* of 98 inches must be provided for required van-accessible parking spaces, access aisles serving them, and vehicular routes between the van-accessible parking spaces and the garage entrance and exit.

603.15 Mechanical protection. Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by *approved* barriers.

603.16 Weather protection. Ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be protected against the elements.

603.17 Air dispersion systems. Air dispersion systems shall:

1. Be installed entirely in exposed locations.
2. Be utilized in systems under positive pressure.
3. Not pass through or penetrate fire-resistant-rated construction.
4. Be *listed* and *labeled* in compliance with UL 2518.

603.18 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's instructions. Volume dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser. Each volume damper or other means of supply air adjustment used in balancing shall be provided with access.

603.18.1 Floor registers. Floor registers shall resist, without structural failure, a 200-pound (90.8 kg) concentrated load on a 2-inch-diameter (51 mm) disc applied to the most critical area of the exposed face.

603.18.2 Prohibited locations. Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing rooms required by the *International Building Code* to have smooth, hard, non-absorbent surfaces.

Exception: *Dwelling units*.

SECTION 604
INSULATION

604.1 General. Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and the *International Energy Conservation Code*.

604.2 Surface temperature. Ducts that operate at temperatures exceeding 120°F (49°C) shall have sufficient thermal insulation to limit the exposed surface temperature to 120°F (49°C).

604.3 Coverings and linings. Duct coverings and linings, including adhesives where used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Duct coverings and linings shall not flame, glow, smol-

SECTION 605
AIR FILTERS

[W] 605.1 General. ((~~Heating and air-conditioning~~)) Air handlers and ventilation systems shall be provided with *approved* air filters in accordance with Section 605.4. Filters shall be installed such that all return air, recirculated air, outdoor air and *makeup air* is filtered upstream from any heat exchanger or coil. Filters shall be installed in an *approved* convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325ºF (163ºC).

Exceptions:

1. Cooling coils that are designed, controlled and operated to provide sensible cooling only do not require filtration at the terminal device.
2. Ambient air that enters the building through intentional openings for natural ventilation or by infiltration is not required to be filtered.
3. Recirculated air serving systems without wetted cooling coils or with unducted heater (hydronic coils, fossil fuel heating elements or electric resistance heating elements) do not require filtration at the terminal device.

605.2 Approval. Media-type and electrostatic-type air filters shall be *listed* and *labeled*. Media-type air filters shall comply with UL 900. High-efficiency particulate air filters shall comply with UL 586. Electrostatic-type air filters shall comply with UL 867. Air filters utilized within *dwelling units* shall be designed for the intended application and shall not be required to be *listed* and *labeled*.

605.3 Airflow over the filter. Ducts shall be constructed to allow an even distribution of air over the entire filter.

[W] 605.4 Particulate matter removal. Particulate matter filters or air cleaners shall have a minimum efficiency reporting value (MERV) of not less than the following:

1. MERV 13 for ducted air handlers and ventilation systems serving occupiable spaces in Groups A, B, E, M, R and I occupancies.
2. MERV 8 for ducted air handlers and ventilation systems serving occupiable spaces in Groups F, H, S, and U occupancies.
3. MERV 4 for unducted air handlers and fan coil units.

Exceptions:

1. Ducted air handlers and ventilation systems 500 cfm or less shall have a filter not less than MERV 8.
2. Recirculated air at fan powered variable air volume terminal units with hydronic heating coils or electric resistance heating elements shall have a filter not less than MERV 8.
3. Exhaust or relief air upstream of a heat exchanger or coil shall have a filter not less than MERV 6.

[S] 605.5 Smoke filtration. Air handlers and energy recovery ventilators serving occupiable spaces each with individual capacity greater than 500 cfm shall provide a filter box capable of housing a filter with a minimum efficiency reporting value (MERV) of not less than 13.

Exception: Air handlers that process 100 percent recirculated air with no outdoor air are not required to comply with this section.

SECTION 606
SMOKE DETECTION SYSTEMS CONTROL

606.1 Controls required. Air distribution systems shall be equipped with smoke detectors *listed* and *labeled* for installation in air distribution systems, as required by this section. Duct smoke detectors shall comply with UL 268A. Other smoke detectors shall comply with UL 268.

[S] 606.2 Where required. Smoke detectors shall be installed where indicated in Sections 606.2.1 through ((~~606.2.3~~)) 606.2.5.

Exception: Smoke detectors shall not be required where air distribution systems are incapable of spreading smoke beyond the enclosing walls, floors and ceilings of the room or space in which the smoke is generated.

[S] 606.2.1 Return air systems. Smoke detectors shall be installed in return air systems with a design capacity greater than 2,000 cfm (0.9 m^3/s), in the return air duct or *plenum* upstream of any filters, *exhaust air* connections, outdoor air connections, or decontamination *equipment* and *appliances*.

Exceptions:

1. Smoke detectors are not required in the return air system where all portions of the building served by the air distribution system are protected by area smoke detectors connected to a fire alarm system in accordance with the *International Fire Code*. The area smoke detection system shall comply with Section 606.4.

2. Smoke detectors are not required in the air system where all of the air is exhausted and not recirculated back to any portion of the building. Additionally, smoke detectors are not required in the supply system that provide the *makeup air* for the exhaust system.

[S] 606.2.2 Common supply and return air systems. Where multiple air-handling systems share common supply or return air ducts or *plenums* with a combined design capacity greater than 2,000 cfm (0.9 m^3/s), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Individual smoke detectors shall not be required for each fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm (0.9 m^3/s) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 601.2, 606.2.1 and 606.2.3.
2. An *approved* area smoke detector system located in the return air *plenum* serving such units.
3. An area smoke detector system as prescribed in the exception to Section 606.2.1.

((~~In all cases, the smoke detectors shall comply with Sections 606.4 and 606.4.1.~~))

The shutdown of fan-powered terminal units may be performed by a building automation system upon activation of smoke detection as described in Section 606.2.2, Exception Items 1, 2, or 3. The building automation system is not required to be *listed* as a smoke control system and is not required to comply with UL Standard 864: Standard for Control Units and Accessories for Fire Alarm Systems.

606.2.3 Return air risers. Where return air risers serve two or more stories and serve any portion of a return air system having a design capacity greater than 15,000 cfm (7.1 m^3/s), smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or *plenums*.

[W] 606.2.4 Corridors serving Group R occupancies in other than high-rise buildings. Corridors that serve Group R occupancies in other than high-rise buildings and that are mechanically ventilated with supply air shall be equipped with smoke detectors spaced in accordance with NFPA 72. The supply fan shall automatically shut off upon activation of the corridor smoke detectors.

Exception: Corridor smoke detection is not required when air is returned back to the supply fan from the corridor and return air smoke detectors are installed in the return air duct or plenum upstream of any filters, exhaust air connections, outdoor air connections, or decontamination equipment and appliances designed to automatically shut off the supply fan.

[W] 606.2.5 Corridors serving Group R occupancies in high-rise buildings. Corridors that serve Group R occupancies in high-rise buildings and that are mechanically ventilated with supply air shall be equipped with smoke detectors that are spaced in accordance with NFPA 72 and air supply inlets to the corridor shall be provided with smoke/fire dampers. The supply inlet smoke/fire dampers shall automatically close upon activation of the corridor smoke detectors.

Exceptions:

1. Corridor smoke detection is not required to close the supply inlet smoke/fire dampers when the smoke/fire dampers are used as part of an approved building stairwell or elevator hoistway pressurization smoke control system.
2. Corridor smoke detection is not required when air is returned back to the supply fan from the corridor and return air smoke detectors are installed in the return air duct or plenum upstream of any filters, exhaust air connections, outdoor air connections, or decontamination equipment and appliances designed to automatically shut off the supply fan.

[F] 606.3 Installation. Smoke detectors required by this section shall be installed in accordance with NFPA 72. The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system including return air and exhaust or relief air. Access shall be provided to smoke detectors for inspection and maintenance.

[F] 606.4 Controls operation. Upon activation, the smoke detectors shall shut down all operational capabilities of the air distribution system in accordance with the listing and labeling of *appliances* used in the system. Air distribution systems that are part of a smoke control system shall switch to the smoke control mode upon activation of a detector.

[S][F] 606.4.1 Supervision. The duct smoke detectors shall be connected to ((~~a fire alarm system~~)) the building's fire alarm control unit where a fire alarm system is required by Section 907.2 of the *International Fire Code*. Duct detectors shall not activate a fire alarm signal. The actuation of a duct smoke detector shall activate a visible and audible supervisory signal at a constantly attended location. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal, not as a fire alarm.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where the duct smoke detector activates the building's alarm-indicating *appliances*.

2. Class I or II leakage rating as specified in Section 607.3.2.2.

[BF] 607.3.3 Damper actuation. Damper actuation shall be in accordance with Sections 607.3.3.1 through 607.3.3.5 as applicable.

[BF] 607.3.3.1 Fire damper actuation. Primary heat-responsive devices used to actuate fire dampers shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (28°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909 of the *International Building Code*.

Informative Note: Dampers associated with exhaust fans used for hoistway and stairway pressurization are permitted to comply with Section 607.3.3.1, item 2.

[BF] 607.3.3.2 Smoke damper actuation. The smoke damper shall close upon actuation of a *listed* smoke detector or detectors installed in accordance with Section 907.3 of the *International Building Code* and one of the following methods, as applicable:

1. Where a smoke damper is installed within a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet (1524 mm) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper.The detector shall be *listed* for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector shall be installed on either side of the smoke barrier door opening. The detector shall be listed for releasing service if used for direct interface with the damper.
3. Where a smoke damper is installed within an unducted opening in a wall, a spot-type detector shall be installed within 5 feet (1524 mm) horizontally of the damper. The detector shall be listed for releasing service if used for direct interface with the damper.
4. Where a smoke damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a smoke detection system is installed in all areas served by the duct in which the damper will be located, the smoke dampers shall be permitted to be controlled by the smoke detection system.

[BF] 607.3.3.3 Combination fire/smoke damper actuation. Combination fire/smoke damper actuation shall be in accordance with Sections 607.3.3.1 and 607.3.3.2. Combination fire/smoke dampers installed in smoke control system shaft penetrations shall not be activated by local area smoke detection unless it is secondary to the smoke management system controls.

[BF] 607.3.3.4 Ceiling radiation damper actuation. The operating temperature of a ceiling radiation damper actuation device shall be 50°F (28°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

[BF] 607.3.3.5 Corridor damper actuation. Corridor damper actuation shall be in accordance with Sections 607.3.3.1 and 607.3.3.2.

[BF] 607.4 Access and identification. Access and identification of fire and smoke dampers shall comply with Sections 607.4.1 through 607.4.2.

[BF] 607.4.1 Access. Fire and smoke dampers shall be provided with an *approved* means of access that is large enough to permit inspection and maintenance of the damper and its operating parts. Dampers equipped with fusible links, internal operators or both shall be provided with an access door that is not less than 12 inches (305 mm) square or provided with a removable duct section.

[BF] 607.4.1.1 Fire-resistance rating. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

[BF] 607.4.1.2 Restricted access. Where space constraints or physical barriers restrict access to a damper for periodic inspection and testing, the damper shall be a single- or multi-blade damper and shall comply with the remote inspection requirements of NFPA 80 or NFPA 105.

[BF] 607.4.2 Identification. Access points shall be permanently identified on the exterior by a label having letters not less than 1/2 inch (12.7 mm) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER.

[BF] 607.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers, ceiling radiation dampers and corridor dampers shall be provided at the locations prescribed in Sections 607.5.1 through 607.5.7. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and smoke damper shall be provided.

[BF] 607.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 706.11 of the *International Building Code* shall be protected with *listed* fire dampers installed in accordance with their listing.

[BF] 607.5.1.1 Horizontal exits. A *listed smoke damper* designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a *fire wall* that serves as a horizontal *exit.*

[W][BF] 607.5.2 Fire barriers. Ducts and air transfer openings that penetrate fire barriers shall be protected with *listed* fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for interior exit stairways and ramps and exit passageways except as permitted by Sections 1023.5 and 1024.6, respectively, of the *International Building Code*.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an *approved* smoke control system in accordance with Section 513 and where the fire damper would interfere with the operation of the smoke control system.
3. Such walls are penetrated by fully ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code*. For the purposes of this exception, a fully ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage [0.0217 inch (0.55 mm)] thickness and shall be continuous from the air-handling *appliance* or *equipment* to the air outlet and inlet terminals. Flexible air connectors shall be permitted in a fully ducted system, limited to the following installations:
   3.1. Nonmetallic flexible connections that connect a duct to an air handling unit or *equipment* located within a mechanical room or located outdoors in accordance with Section 603.9.
   3.2. Nonmetallic flexible air connectors in accordance with Section 603.6.2 that connect an overhead metal duct to a ((~~ceiling~~)) diffuser, grille or register where the metal duct and ((~~ceiling~~)) diffuser, grille or register are located within the same room.

[BF] 607.5.2.1 Horizontal exits. A *listed smoke damper* designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a *fire barrier* that serves as a horizontal *exit*.

[W][BF] 607.5.3 Fire partitions. Ducts and air transfer openings that penetrate fire partitions shall be protected with *listed* fire dampers installed in accordance with their listing.

Exception: In *occupancies* other than Group H, fire dampers are not required where any of the following apply:

1. Corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code* and the duct is protected as a through penetration in accordance with Section 714 of the *International Building Code*.
2. The partitions are tenant partitions in covered and open mall buildings where the walls are not required by provisions elsewhere in the *International Building Code* to extend to the underside of the floor or roof sheathing, slab or deck above.
3. The duct system is constructed of *approved* materials in accordance with Section 603 and the duct penetrating the wall complies with all of the following requirements:
   3.1. The duct shall not exceed 100 square inches (0.06 m^2).
   3.2. The duct shall be constructed of steel not less than 0.0217 inch (0.55 mm) in thickness.
   3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
   3.4. The duct shall be installed above a ceiling.
   3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.
   3.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1-1/2-inch by 1-1/2-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with rock (mineral) wool batting on all sides.

4. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, and are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Building Code*. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or *exhaust air* as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage in thickness and shall be continuous from the air-handling *appliance* or *equipment* to the air outlet and inlet terminals.

   4.1. Nonmetallic flexible connections that connect a duct to an air-handling unit or equipment located within a mechanical room or located outdoors in accordance with Section 603.9.

   4.2. Nonmetallic flexible air connectors in accordance with Section 603.6.2 that connect an overhead metal duct to a diffuser, grille, or register where the metal duct and diffuser, grille, or register are located in the same room. Where the fully ducted HVAC system metal ductwork penetrates a corridor fire partition, the ductwork shall be continuous without openings to the corridor, to a mechanical room, or to a shaft enclosure.

[BF] 607.5.4 Corridors/smoke barriers. A *listed* smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier wall or a corridor enclosure required to have smoke and draft control doors in accordance with the *International Building Code*.

A corridor damper shall be provided where corridor ceilings, constructed as required for the corridor walls as permitted in Section 708.4, Exception 3, of the *International Building Code*, are penetrated.

A ceiling radiation damper shall be provided where the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, constructed as permitted in Section 708.4, Exception 2, of the *International Building Code*, is penetrated.

Smoke dampers and smoke damper actuation methods shall comply with Section 607.5.4.1.

Exceptions:

1. Smoke dampers are not required in corridor penetrations where the building is equipped throughout with an *approved* smoke control system in accordance with Section 513 and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in smoke barrier penetrations where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.
3. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.
4. Smoke dampers are not required in smoke barriers required by Section 407.5 of the *International Building Code* for Group I-2, Condition 2 where the HVAC system is fully ducted in accordance with Section 603 and where buildings are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Building Code* and equipped with quick-response sprinklers in accordance with Section 903.3.2 of the *International Building Code*.

[BF] 607.5.4.1 Smoke damper. Smoke dampers shall close as required by Section 607.3.3.2.

[S][BF] 607.5.5 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with listed fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where any of the following apply:

   1.1. Steel exhaust subducts having a wall thickness of not less than 0.0187 inch (0.4712 mm) extend not less than 22 inches (559 mm) vertically in exhaust shafts and an exhaust fan is installed at the upper terminus of the shaft that is powered continuously, in accordance with Section 909.11 of the *International Building Code*, so as to maintain a continuous airflow upward to the outdoors.

   1.2. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.

   1.3. Ducts are used as part of an *approved* smoke control system in accordance with Section 909 of the *International Building Code*, and where the fire damper will interfere with the operation of the smoke control system.

   1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.

2. In Group B and R *occupancies* equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Building Code*, smoke dampers are not required at penetrations of shafts where kitchen, clothes dryer, bathroom, ((~~and~~)) toilet room, accessory storage, and accessory trash room exhaust openings with steel exhaust subducts, having a wall thickness of not less than 0.0187 inch (0.4712 mm), extend not less than 22 inches (559 mm) vertically and the exhaust fan at the upper terminus is ((~~powered continuously in accordance with the provisions of Section 909.11 of the *International Building Code*~~)) provided with a legally required standby power system in accordance with *Seattle Electrical Code* Section 701, and maintains airflow upward to the outdoors.
3. Smoke dampers are not required at penetrations of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an *approved* mechanical smoke control system designed in accordance with Section 909 of the *International Building Code* and where the smoke damper will interfere with the operation of the smoke control system.
5. Fire dampers and combination fire/smoke dampers are not required in kitchen and clothes dryer exhaust systems where dampers are prohibited by this code.

[BF] 607.5.5.1 Continuous upward flow. Fire dampers and smoke dampers shall not be installed in shafts that are required to maintain continuous airflow upward where closure of the damper would result in the loss of airflow.

[BF] 607.5.5.2 Enclosure at the bottom. Shaft enclosures that do not extend to the bottom of the building or structure shall be protected in accordance with Section 713.11 of the *International Building Code*.

[BF] 607.5.6 Exterior walls. Ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section 705.10 of the *International Building Code* shall be protected with *listed* fire dampers installed in accordance with their listing.

[BF] 607.5.7 Smoke partitions. A *listed* smoke damper designed to resist the passage of smoke shall be provided at each point where an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section 607.3.3.2.

Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 513, *approved* alternative protection shall be used.

[BF] 607.6 Horizontal assemblies. Penetrations by air ducts of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 713 and Sections 717.6.1 through 717.6.3 of the *International Building Code* or shall comply with Sections 607.6.1 through 607.6.3.

[BF] 607.6.1 Through penetrations. In *occupancies* other than Groups I-2 and I-3, a duct constructed of *approved* materials in accordance with Section 603 that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided that a *listed* fire damper is installed at the floor line or the duct is protected in accordance with Section 714.5 of the *International Building Code*. For air transfer openings, see Item 6, Section 712.1.9 of the *International Building Code*.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor provided that it meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage).
2. The duct shall open into only one *dwelling unit* or *sleeping unit* and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed a 4-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches for any 100 square feet (64 516 mm^2 per 9.3 m^2) of the floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a *listed* ceiling radiation damper installed in accordance with Section 607.6.2.1.

[BF] 607.6.2 Membrane penetrations. Ducts and air transfer openings constructed of *approved* materials, in accordance with Section 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 713 of the *International Building Code*.

CHAPTER 7

COMBUSTION AIR

User note:

About this chapter: *Chapter 7 defers to the* International Fuel Gas Code® *for combustion air provisions for gas-fired appliances. This code addresses oil-fired and solid-fuel-fired appliances; therefore, Chapter 7 is brief, referring to the manufacturer for solid-fuel appliances and NFPA 31 for oil-fired appliances. Combustion air must be provided to appliances to prevent poor combustion that can create multiple health and safety hazards.*

SECTION 701
GENERAL

[S] 701.1 Scope. This chapter shall apply to oil-burning *appliances* and *equipment* to ensure that adequate air for safe *combustion* is provided. Solid fuel-burning *appliances*, *fireplaces* and *fireplace stoves* shall be provided with *combustion air* in accordance with the *appliance* manufacturer's installation instructions and *International Building Code* Section 2111. ((~~Oil-fired *appliances* shall be provided with *combustion air* in accordance with NFPA 31. The methods of providing *combustion air* in this chapter do not apply to fireplaces, fireplace stoves and direct~~)) Direct-vent *appliances* shall be provided with *combustion* air in accordance with the appliance manufacturer's installation instructions. The requirements for combustion and dilution air for gas-fired *appliances* shall be in accordance with the *International Fuel Gas Code*.

701.2 Dampered openings. Where combustion air openings are provided with volume, smoke or fire dampers, the dampers shall be interlocked with the firing cycle of the *appliances* served, so as to prevent operation of any *appliance* that draws combustion air from the room or space when any of the dampers are closed. Manual dampers shall not be installed in combustion air ducts. Ducts not provided with dampers and that pass through rated construction shall be enclosed in a shaft in accordance with the *International Building Code*.

[S] 701.3 Oil-burning appliance and equipment installation location. Oil-burning appliances and *equipment* shall be installed in locations where available ventilation permits satisfactory *combustion* of oil, proper venting of *combustion* gases, and maintenance of safe ambient temperatures under normal conditions of use. Appliances shall be located so that they do not interfere with the supply of air within the space.

Note: The provisions of Chapter 7 are based on NFPA 31-2016.

[S] 701.4 Tight construction. Where buildings are so tight that normal infiltration does not provide sufficient air for *combustion*, outside air shall be introduced.

[S] 701.5 Combustion air ducts. *Combustion* air ducts shall:

1. Be of galvanized steel complying with Chapter 6 or of equivalent corrosion-resistant material *approved* for this application.

   Exception: Within *dwelling units*, unobstructed stud and joist spaces shall not be prohibited from conveying *combustion* air, provided that not more than one required fireblock is removed.
2. Have a minimum cross-sectional dimension of 3 inches (76 mm).
3. Terminate in an unobstructed space allowing free movement of *combustion* air to the appliances.
4. Have the same cross-sectional areas as the free area of the openings to which they connect.
5. Serve a single appliance enclosure.
6. Not serve both upper and lower *combustion* air openings where both such openings are used. The separation between ducts serving upper and lower *combustion* air openings shall be maintained to the source of *combustion* air.
7. Not be screened where terminating in an attic space.
8. Not slope downward toward the source of *combustion* air, where serving the upper required *combustion* air opening.

[S] 701.6 Prohibited sources. Openings and ducts shall not connect appliance enclosures with a space in which the operation of a fan will adversely affect the flow of the *combustion* air. *Combustion* air shall not be obtained from a hazardous location, except where the fuel-fired appliances are located within the hazardous location and are installed in accordance with this code. *Combustion* air shall not be taken from a refrigeration *machinery room*, except where a refrigerant vapor detector system is installed to automatically shut off the *combustion* process in the event of refrigerant leakage. *Combustion* air shall not be obtained from any location below the *design flood elevation*.

[S] 701.7 Opening location and protection. *Combustion* air openings to the outdoors shall comply with the location and protection provisions of Sections 401.4 and 401.5 applicable to outdoor air intake openings.

[S] SECTION 702
APPLIANCES LOCATED IN UNCONFINED SPACES

[S] 702.1 Unconfined spaces. In *unconfined spaces* air for *combustion* and ventilation shall be obtained directly from outdoors or from spaces that freely communicate with outdoors by means of a permanent opening or openings having a total free area of not less than 1 in.^{2} per 5000 Btu/hr (28 in.^{2} per gal/hr) (4.4 cm^2 kW), based on the total input rating of all appliances in the space.

Exception: In buildings built prior to the 1986 edition of the *Washington State Energy Code with Seattle Amendments*, air for *combustion* shall be permitted to be supplied by normal infiltration.

[S] SECTION 703
APPLIANCES LOCATED IN CONFINED SPACES

[S] 703.1 Confined spaces. For appliances installed in confined spaces, air for *combustion* and ventilation shall be provided using one of the methods set forth in this section.

[S] 703.2 All air taken from inside the building. Where all *combustion* air will be taken from inside the building, the confined space shall be provided with two permanent openings as shown in Figure 703.2.1, one near the top of the space and one near the bottom.

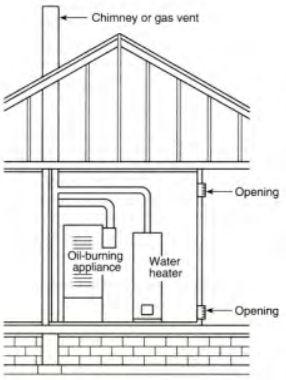


FIGURE 703.2.1
APPLIANCES LOCATED IN CONFINED SPACES – ALL AIR TAKEN FROM INSIDE THE BUILDING

[S] 703.2.1 Size of openings. Each opening shall have a free area of not less than 1 in.^{2} per 1000 Btu/hr (140 in.^{2} per gal/hr) (22 cm^2/kW), based on the total input rating of all appliances in the space.

[S] 703.2.2 Source of air. Each opening shall freely communicate with interior areas of the building that, in turn, have adequate infiltration from the outside.

[S] 703.3 All air taken from outdoors. Where all air will be taken from outdoors, the confined space shall be provided with two permanent openings, one near the top of the space and one in or near the bottom.

[S] 703.3.1 Source of air. The openings shall communicate directly or by means of ducts with the outdoors or to spaces such as an attic or crawl space, that themselves freely communicate with the outdoors, as shown in Figure 703.3.2.1, Figure 703.3.2.2, and Figure 703.3.2.3.

[S] 703.3.2 Vertical ducts. Where communicating with the outdoors directly or by means of vertical ducts, each opening shall have a free area of not less than 1 inch^2 per 4000 Btu/hr (35 inch^2 per gal/hr) (5.5 cm^2/kW), based on the total input rating of all appliances in the space.

[S] 703.3.3 Horizontal ducts. Where communicating with the outdoors by means of horizontal ducts, each opening shall have a free area of not less than 1 inch^2 per 2000 Btu/hr (70 inch^2 per gal/hr) (11 cm^2/kW), based on the total input rating of all appliances in the space.

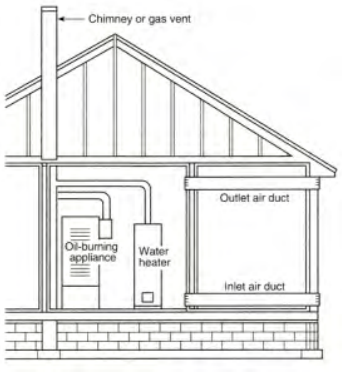


FIGURE 703.3.2.1
APPLIANCES LOCATED IN CONFINED SPACES –
ALL AIR FROM OUTDOORS

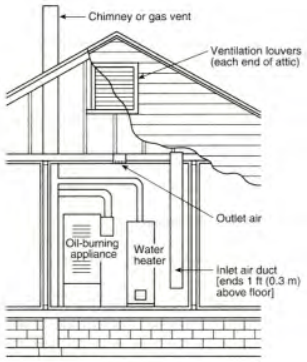
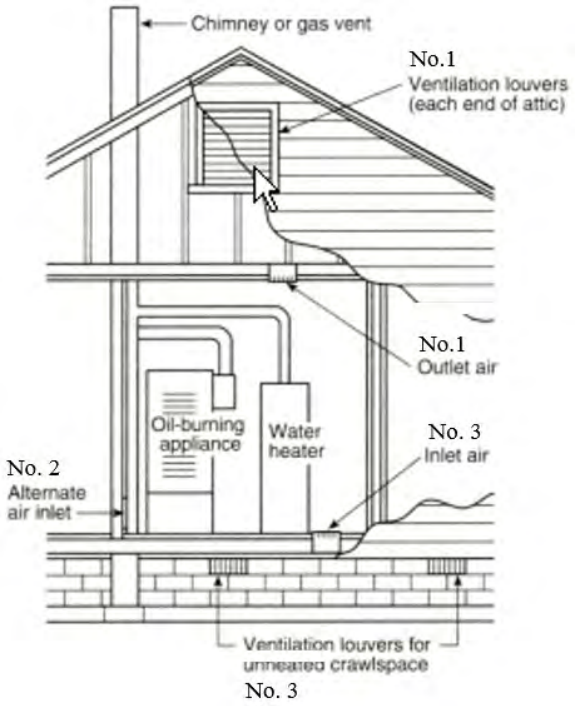


FIGURE 703.3.2.2
APPLIANCES LOCATED IN CONFINED SPACES –
ALL AIR FROM OUTDOORS THROUGH VENTILATED ATTIC



Notes:

- Ducts used for make-up air can be connected to the cold air return of the heating system only if they connect directly to outdoor air.
- Nos. 1, 2, and 3 mark alternate locations for air from outdoors.
- Provide attic ventilation louvers at each end of attic with alternate air inlet No. 1.
- Provide crawl space ventilation louvers for unheated crawl space with alternate air inlet No. 3.

FIGURE 703.3.2.3
APPLIANCES LOCATED IN CONFINED SPACES, WITH VENTILATION AIR FROM INSIDE BUILDING AND COMBUSTION AIR FROM OUTSIDE, VENTILATED ATTIC, OR VENTILATED CRAWL SPACE

[S] 703.4 Ventilation air taken from inside the building—Combustion air taken from outdoors. Where *ventilation air* will be taken from inside the building and *combustion* air will be taken from outdoors, the confined space shall be provided with two openings for ventilation, located and sized as specified in Section 703.2 and as shown in Figure 703.3.2.3. In addition, there shall be one opening communicating directly with the outdoors or to spaces, such as an attic or crawl space, that freely communicates with the outdoors and has a free area of not less than 1 $in.^2$ per 5000 Btu/hr (28 $in.^2$ per gal/hr) (4.4 cm^2/kW), based on the total input of all appliances in the space.

[S] SECTION 704
COMBUSTION AIR FOR COMMERCIAL AND INDUSTRIAL INSTALLATIONS

[S] 704.1 General. For commercial and industrial oil-burning *equipment*, permanent means for supplying an ample amount of outside air shall be provided in accordance with this section.

[S] 704.2 Size of openings. For furnace or boiler rooms adjacent to outside walls and where *combustion* air is provided by *natural ventilation* from the outside, there shall be a permanent air supply inlet having a total free area of not less than 1 $in.^2$ per 4000 Btu/hr (35 $in.^2$ per gal/hr) (5.5 cm^2/kW), based on the total input rating of the burner or burners, but in no case less than 35 $in.^2$ (0.425 m^2). For furnace or boiler rooms that are not adjacent to outside walls, the *combustion* air shall be supplied in a manner acceptable to the building official.

[S] SECTION 705
LOUVERS AND GRILLES

[S] 705.1 Louvers and grilles. In calculating the free area required by Sections 701, 702, 703 and 704, the blocking effect of louvers, grilles, or screens protecting openings shall be taken into consideration.

[S] 705.2 Screens. Screens used in louvers or grilles shall not be smaller than 1/4 in (6.3 mm) mesh and shall be accessible for cleaning.

[S] 705.3 Size of openings. If the free area through a particular design of louver or grille is known, it shall be used in calculating the size of the opening needed to provide the free area required. If the free area of the design is not known, it shall be assumed that wood louvers will have 20 percent to 25 percent free area and metal louvers and grilles will have 60 percent to 75 percent free area.

[S] SECTION 706
SPECIAL CONDITIONS

[S] 706.1 Special conditions. Where an appliance is installed in a location where the operation of exhaust fans, kitchen ventilation systems, clothes dryers or fireplaces can create conditions of unsatisfactory *combustion* or venting, special provisions shall be made subject to the approval of the building official.

SECTION 804
DIRECT-VENT, INTEGRAL VENT AND MECHANICAL DRAFT SYSTEMS

804.1 Direct-vent terminations. Vent terminals for *direct-vent appliances* shall be installed in accordance with the manufacturer's instructions.

804.2 Appliances with integral vents. *Appliances* incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

804.2.1 Terminal clearances. *Appliances* designed for natural draft venting and incorporating integral venting means shall be located so that a minimum *clearance* of 9 inches (229 mm) is maintained between vent terminals and from any openings through which *combustion* products enter the building. *Appliances* using forced draft venting shall be located so that a minimum *clearance* of 12 inches (305 mm) is maintained between vent terminals and from any openings through which *combustion* products enter the building.

804.3 Mechanical draft systems. Mechanical draft systems of either forced or induced draft design shall be *listed* and *labeled* in accordance with UL 378 and shall comply with Sections 804.3.1 through 804.3.8.

804.3.1 Forced draft systems. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to be gas tight to prevent leakage of *combustion* products into a building.

804.3.2 Automatic shutoff. Power exhausters serving automatically fired *appliances* shall be electrically connected to each *appliance* to prevent operation of the *appliance* when the power exhauster is not in operation.

804.3.3 Termination. The termination of *chimneys* or vents equipped with power exhausters shall be located not less than 10 feet (3048 mm) from the lot line or from adjacent buildings. The exhaust shall be directed away from the building.

[S] 804.3.4 Horizontal terminations. Horizontal terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than ((~~7~~)) 10 feet (((~~2134~~)) 3048 mm) above the level of the walkway.
2. Vents shall terminate not less than 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).
3. The vent system shall terminate not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, window or gravity air inlet into the building.
4. The vent termination point shall not be located closer than 3 feet (914 mm) to an interior corner formed by two walls perpendicular to each other.
5. The vent termination shall not be mounted directly above or within 3 feet (914 mm) horizontally from an oil tank vent or gas meter.
6. The bottom of the vent termination shall be located not less than 12 inches (305 mm) above finished grade.

[S] 804.3.5 Vertical terminations. Vertical terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than ((~~7~~)) 10 feet (((~~2134~~)) 3048 mm) above the level of the walkway.
2. Vents shall terminate not less than 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm). ((~~horizontally.~~))
3. Where the vent termination is located below an adjacent roof structure, the termination point shall be located not less than 3 feet (914 mm) from such structure.
4. The vent shall terminate not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, window or gravity air inlet for the building.
5. A vent cap shall be installed to prevent rain from entering the vent system.
6. The vent termination shall be located not less than 3 feet (914 mm) horizontally from any portion of the roof structure.

804.3.6 Exhauster connections. An *appliance* vented by natural draft shall not be connected into a vent, *chimney* or vent connector on the discharge side of a mechanical flue exhauster.

804.3.7 Exhauster sizing. Mechanical flue exhausters and the vent system served shall be sized and installed in accordance with the manufacturer's installation instructions.

804.3.8 Mechanical draft systems for manually fired appliances and fireplaces. A mechanical draft system shall be permitted to be used with manually fired *appliances* and fireplaces where such system complies with all of the following requirements:

1. The mechanical draft device shall be *listed* and *labeled* in accordance with UL 378, and shall be installed in accordance with the manufacturer's instructions.

labeled in accordance with the requirements of UL 1482 and shall be installed in accordance with the manufacturer's instructions. New wood-burning residential hydronic heaters shall be EPA certified.

905.2 Connection to fireplace. The connection of solid fuel *appliances* to *chimney* flues serving fireplaces shall comply with Sections 801.7 and 801.10.

905.3 Hearth extensions. Hearth extensions for fireplace stoves shall be installed in accordance with the listing of the fireplace stove. The hearth extension shall be readily distinguishable from the surrounding floor area. *Listed* and *labeled* hearth extensions shall comply with UL 1618.

SECTION 906
FACTORY-BUILT BARBECUE APPLIANCES

906.1 General. Factory-built barbecue *appliances* shall be of an *approved* type and shall be installed in accordance with the manufacturer's instructions, this chapter and Chapters 3, 5, 7 and 8, and the *International Fuel Gas Code*.

SECTION 907
INCINERATORS AND CREMATORIES

907.1 General. Incinerators and crematories shall be *listed* and *labeled* in accordance with UL 791 and shall be installed in accordance with the manufacturer's instructions.

SECTION 908
COOLING TOWERS, EVAPORATIVE CONDENSERS AND FLUID COOLERS

908.1 General. A cooling tower used in conjunction with an air-conditioning *appliance* shall be installed in accordance with the manufacturer's instructions. Factory-built cooling towers shall be *listed* in accordance with UL 1995 or UL/CSA 60335-2-40.

908.2 Access. Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

908.3 Location. Cooling towers, evaporative condensers and fluid coolers shall be located to prevent the discharge of vapor plumes from entering occupied spaces. Plume discharges shall be not less than 5 feet (1524 mm) above or 20 feet (6096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings in accordance with the *International Building Code*.

908.4 Support and anchorage. Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the *International Building Code*. Seismic restraints shall be as required by the *International Building Code*.

[S] 908.5 Water supply. Cooling towers, evaporative coolers and fluid coolers shall be provided with an approved water supply, sized for peak demand. The quality of water shall be provided in accordance with the *equipment* manufacturer's recommendations. The piping system and protection of the potable water supply system shall be installed as required by the ((~~*International*~~)) *Uniform Plumbing Code*.

908.6 Drainage. Drains, overflows and blowdown provisions shall be indirectly connected to an *approved* disposal location. Discharge of chemical waste shall be *approved* by the appropriate regulatory authority.

908.7 Refrigerants and hazardous fluids. Heat exchange *equipment* that contains a refrigerant and that is part of a closed refrigeration system shall comply with Chapter 11. Heat exchange *equipment* containing heat transfer fluids which are flammable, combustible or hazardous shall comply with the *International Fire Code*.

908.8 Cooling towers. Cooling towers, both open circuit and closed circuit type, and evaporative condensers shall comply with Sections 908.8.1 and 908.8.2.

908.8.1 Conductivity or flow-based control of cycles of concentration. Cooling towers and evaporative condensers shall include controls that automate system bleed based on conductivity, fraction of metered makeup volume, metered bleed volume, recirculating pump run time or bleed time.

908.8.2 Drift eliminators. Cooling towers and evaporative condensers shall be equipped with drift eliminators that have a maximum drift rate of 0.005 percent of the circulated water flow rate as established in the *equipment's* design specifications.

SECTION 913
CLOTHES DRYERS

913.1 General. Clothes dryers shall be installed in accordance with the manufacturer's instructions. Electric residential clothes dryers shall be tested in accordance with UL 2158. Electric coin-operated clothes dryers shall be tested in accordance with UL 2158. Electric commercial clothes dryers shall be tested in accordance with UL 1240.

913.2 Exhaust required. Clothes dryers shall be exhausted in accordance with Section 504.

913.3 Clearances. Clothes dryers shall be installed with *clearance* to combustibles in accordance with the manufacturer's instructions.

SECTION 914
SAUNA HEATERS

914.1 Location and protection. Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

914.1.1 Guards. Sauna heaters shall be protected from accidental contact by an *approved* guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

914.2 Installation. Sauna heaters shall be *listed* and *labeled* in accordance with UL 875 and shall be installed in accordance with their listing and the manufacturer's instructions.

914.3 Access. Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

914.4 Heat and time controls. Sauna heaters shall be equipped with a thermostat that will limit room temperature to 194ºF (90ºC). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 6 inches (152 mm) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support, and shall be protected against physical damage.

914.4.1 Timers. A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

914.5 Sauna room. A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

914.5.1 Warning notice. The following permanent notice, constructed of *approved* material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 1/4-inch (6.4 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

SECTION 915
ENGINE AND GAS TURBINE-POWERED EQUIPMENT AND APPLIANCES

915.1 General. The installation of liquid-fueled stationary internal *combustion* engines and gas turbines, including exhaust, fuel storage and piping, shall meet the requirements of NFPA 37. Stationary engine generator assemblies shall meet the requirements of UL 2200.

915.2 Powered equipment and appliances. Permanently installed *equipment* and *appliances* powered by internal *combustion* engines and turbines shall be installed in accordance with the manufacturer's instructions and NFPA 37.

[W][S] 915.3 Installation of emergency and legally required power systems. Emergency power systems and legally required standby power systems required by the *International Building Code* or *International Fire Code* shall be installed in accordance with the *International Fire Code*, NFPA 70, NFPA 110, and NFPA 111.

Exceptions:

1. Where located within a sprinklered parking garage of Type I or II construction, emergency power and *legally required standby power systems* with fixed fuel quantities meeting the limits of Section 605.4 of the *International Fire Code*, and their transfer switches, are not required to be in a separate room. Other occupancies located in the story where the system is located shall be separated from the system by fire barriers with a minimum 1-hour fire resistance rating.

2. Combustion and radiator intake air are permitted to be transferred from the adjacent garage. Radiator discharge air is permitted to be transferred to the adjacent garage. Radiator ventilation intake and discharge air locations shall be separated to maintain the radiator ventilation intake air temperature below the maximum temperature allowed to meet the emergency and *legally required standby power system* loads.

915.3.1 Air intakes. Air intake opening locations for combustion and radiator cooling intake air shall be located on the exterior of the building in accordance with NFPA 110 and a minimum of 5 feet from the property line.

915.3.2 Air outlets. Air outlet opening locations shall comply with the following:

1. Combustion exhaust shall be located on the exterior of the building in accordance with Section 501.3.1 Item 2 for product conveying exhaust.
2. Radiator cooling outlet air shall be located on the exterior of the building in accordance with NFPA 110, a minimum of 5 feet from the property line and a minimum of 2 feet above grade.

915.4 Installation of optional standby power systems. Optional standby power systems shall be installed in accordance with the *International Fire Code*, NFPA 37, NFPA 70, and NFPA 111 as applicable.

915.4.1 Air intakes. Air intake opening locations for combustion and radiator cooling intake air shall be located on the exterior of the building in accordance with NFPA 110 and a minimum of 5 feet from the property line and may be located within an open or enclosed parking garage with sufficient exterior permanent opening area to provide the intake air.

915.4.2 Air outlets. Air outlet opening locations shall comply with the following:

1. Combustion exhaust shall be located on the exterior of the building in accordance with Section 501.3.1 Item 2 for product conveying exhaust.
2. Radiator cooling outlet air shall be located a minimum of 5 feet from the property line and may be discharged into an open or enclosed parking garage with sufficient exterior permanent opening area to relieve heat from the generator.

SECTION 916
POOL AND SPA HEATERS

916.1 General. Pool and spa heaters shall be installed in accordance with the manufacturer's instructions. Oil-fired pool and spa heaters shall be tested in accordance with UL 1261. Pool and spa heat pump water heaters shall comply with UL 1995, UL/CSA 60335-2-40 or CSA C22.2 No. 236.

Exception: Portable residential spas and portable residential exercise spas shall comply with UL 1563 or CSA C22.2 No. 218.1.

SECTION 917
COOKING APPLIANCES

917.1 Cooking appliances. Cooking *appliances* that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles and barbecues, shall be *listed, labeled* and installed in accordance with the manufacturer's instructions. Commercial electric cooking *appliances* shall be *listed* and *labeled* in accordance with UL 197. Household electric ranges shall be *listed* and *labeled* in accordance with UL 858. Microwave cooking *appliances* shall be *listed* and *labeled* in accordance with UL 923. Oil-burning stoves shall be *listed* and *labeled* in accordance with UL 896. Solid-fuel-fired ovens shall be *listed* and *labeled* in accordance with UL 2162.

917.2 Domestic appliances. Cooking *appliances* installed within *dwelling units* and within areas where domestic cooking operations occur shall be *listed* and *labeled* as household-type *appliances* for domestic use.

[S] SECTION 918
((~~FORCED-AIR WARM-AIR FURNACES~~)) AIR HANDLING UNITS

918.1 Forced-air furnaces. Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1995 or UL/CSA 60335-2-40. Solid fuel furnaces shall be tested in accordance with UL 391. Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's instructions.

918.2 Heat pumps. Electric heat pumps shall be tested in accordance with UL 1995 or UL/CSA 60335-2-40.

918.3 Dampers. Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

SECTION 926
GASEOUS HYDROGEN SYSTEMS

926.1 Installation. The installation of gaseous hydrogen systems shall be in accordance with the applicable requirements of this code, the *International Fire Code*, the *International Fuel Gas Code* and the *International Building Code*.

SECTION 927
RADIANT HEATING SYSTEMS

927.1 General. Electric radiant heating systems shall be installed in accordance with the manufacturer's instructions and shall be *listed* for the application.

[S] 927.2 Clearances. *Clearances* for radiant heating panels or elements to any wiring, outlet boxes and junction boxes used for installing electrical devices or mounting luminaires shall be in accordance with the *International Building Code* and ((~~NFPA 70~~)) the *Seattle Electrical Code*.

927.3 Installation on wood or steel framing. Radiant panels installed on wood or steel framing shall conform to the following requirements:

1. Heating panels shall be installed parallel to framing members and secured to the surface of framing members or shall be mounted between framing members.
2. Mechanical fasteners shall penetrate only the unheated portions provided for this purpose. Panels shall not be fastened at any point closer than 1/4 inch (6.4 mm) to an element. Other methods of attachment of the panels shall be in accordance with the panel installation instructions.
3. Unless *listed* and *labeled* for field cutting, heating panels shall be installed as complete units.

927.4 Installation in concrete or masonry. Radiant heating systems installed in concrete or masonry shall conform to the following requirements:

1. Radiant heating systems shall be identified as being suitable for the installation, and shall be secured in place as specified in the manufacturer's instructions.
2. Radiant heating panels and radiant heating panel sets shall not be installed where they bridge expansion joints unless they are protected from expansion and contraction.

927.5 Finish surfaces. Finish materials installed over radiant heating panels and systems shall be installed in accordance with the manufacturer's instructions. Surfaces shall be secured so that fasteners do not pierce the radiant heating elements.

SECTION 928
EVAPORATIVE COOLING EQUIPMENT

928.1 General. Evaporative cooling *equipment* shall:

1. Be installed in accordance with the manufacturer's instructions.
2. Be installed on level platforms in accordance with Section 304.10.
3. Have openings in exterior walls or roofs flashed in accordance with the *International Building Code*.
4. Be provided with an approved water supply, sized for peak demand. The quality of water shall be provided in accordance with the *equipment* manufacturer's recommendations. The piping system and protection of the potable water supply system shall be installed as required by the *International Plumbing Code*.
5. Have air intake opening locations in accordance with Section 401.4.

SECTION 929
UNVENTED ALCOHOL FUEL-BURNING DECORATIVE APPLIANCES

929.1 General. *Unvented alcohol fuel-burning decorative appliances* shall be *listed* and *labeled* in accordance with UL 1370 and shall be installed in accordance with the conditions of the listing, manufacturer's installation instructions and Chapter 3.

SECTION 930
LARGE-DIAMETER CEILING FANS

930.1 General. Where provided, large-diameter ceiling fans shall be tested and *labeled* in accordance with AMCA 230, *listed* and *labeled* in accordance with UL 507, and installed in accordance with the manufacturer's instructions.

CHAPTER 10

BOILERS, WATER HEATERS AND PRESSURE VESSELS

Note: Chapter 10 is not adopted in The City of Seattle.
Boilers, *water heaters*, and pressure vessels are regulated by the *Seattle Boiler and Pressure Vessel Code*.

CHAPTER 11

REFRIGERATION

User note:

About this chapter: *Chapter 11 provides for the protection of life and property from the potential fire and health hazards associated with refrigerant chemicals and the machinery that contains such chemicals. Some refrigerants are toxic, some are flammable and some are both. This chapter refers to the* International Fire Code®*, ASHRAE 15 and IIAR standards 2 through 5.*

SECTION 1101
GENERAL

1101.1 Scope. This chapter shall govern the design, installation, construction and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigerating cycle. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached.

[S] 1101.1.1 Refrigerants other than ammonia. Refrigerant piping design and installation for systems containing a refrigerant other than ammonia, including pressure vessels and pressure relief devices, shall comply with this chapter, ((~~and~~)) ASHRAE 15 and the *Seattle Boiler and Pressure Vessel Code*.

1101.1.2 Ammonia refrigerant. Refrigeration systems using ammonia as the refrigerant shall comply with IIAR 2, IIAR 3, IIAR 4 and IIAR 5 and shall not be required to comply with this chapter.

1101.2 Factory-built equipment and appliances. *Listed* and *labeled* self-contained, factory-built *equipment* and *appliances* shall be tested in accordance with the applicable standards specified in Table 1101.2. Such *equipment* and *appliances* are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's instructions.

TABLE 1101.2
FACTORY-BUILT EQUIPMENT AND APPLIANCES

EQUIPMENT	STANDARDS
Refrigeration fittings, including press-connect, flared and threaded	UL 109 and UL 207
Air-conditioning equipment	UL 1995 or UL/CSA 60335-2-40
Packaged terminal air conditioners and heat pumps	UL 484 or UL/CSA 60335-2-40
Split-system air conditioners and heat pumps	UL 1995 or UL/CSA 60335-2-40
Dehumidifiers	UL 474 or UL/CSA 60335-2-40
Unit coolers	UL 412 or UL/CSA 60335-2-89
Commercial refrigerators, freezers, beverage coolers and walk-in coolers	UL 471 or UL/CSA 60335-2-89
Refrigerating units and walk-in coolers	UL 427 or UL 60335-2-89
Refrigerant-containing components and accessories	UL 207

1101.3 Protection. Any portion of a refrigeration system that is subject to physical damage shall be protected in an *approved* manner.

[S] 1101.4 Water connection. Water supply and discharge connections associated with refrigeration systems shall be made in accordance with this code and the ((~~*International*~~)) *Uniform Plumbing Code*.

1101.5 Fuel gas connection. Fuel gas devices, *equipment* and *appliances* used with refrigeration systems shall be installed in accordance with the *International Fuel Gas Code*.

1101.6 Maintenance. Mechanical refrigeration systems shall be maintained in proper operating condition, free from accumulations of oil, dirt, waste, excessive corrosion, other debris and leaks.

1101.7 Change in refrigerant type. The type of refrigerant in refrigeration systems having a refrigerant circuit containing more than 220 pounds (99.8 kg) of Group A1 or 30 pounds (13.6 kg) of any other group refrigerant shall not be changed without prior notification to the code official and compliance with the applicable code provisions for the new refrigerant type.

[F] 1101.8 Refrigerant discharge. Notification of refrigerant discharge shall be provided in accordance with the *International Fire Code*.

1101.9 Locking access port caps. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

Exceptions:

1. *Machinery rooms* are not required for *listed equipment* and *appliances* containing not more than 6.6 pounds (3 kg) of refrigerant, regardless of the refrigerant's safety classification, where installed in accordance with the *equipment's* or *appliance's* listing and the *equipment* or *appliance* manufacturer's installation instructions.
2. Piping in compliance with Section 1107 is allowed in other locations to connect components installed in a *machinery room* with those installed outdoors.

1104.2.1 Institutional occupancies. The amounts shown in Table 1103.1 shall be reduced by 50 percent for all areas of institutional *occupancies* except kitchens, laboratories and mortuaries. The total of all Group A2, B2, A3 and B3 refrigerants shall not exceed 550 pounds (250 kg) in occupied areas or *machinery rooms*.

[S] 1104.2.2 Industrial occupancies and refrigerated rooms. This section applies only to rooms and spaces that: are within industrial *occupancies*; contain a refrigerant evaporator; are maintained at temperatures below 68°F (20°C); and are used for manufacturing, food and beverage preparation, meat cutting, other processes and storage. Where a *machinery room* would otherwise be required by Section 1104.2, a *machinery room* shall not be required where all of the following conditions are met:

1. The space containing the machinery is separated from other *occupancies* by tight construction with tight-fitting doors.
2. Access is restricted to authorized personnel.
3. Refrigerant detectors are installed as required for *machinery rooms* in accordance with Section 1105.3.

   Exception: Refrigerant detectors are not required in unoccupied areas that contain only continuous piping that does not include valves, valve assemblies, *equipment* or *equipment* connections.
4. Surfaces having temperatures exceeding 800°F (427°C) and open flames are not present where any Group A2, B2, A3 or B3 refrigerant is used (see Section 1104.3.4).
5. All electrical *equipment* and *appliances* conform to Class I, Division 2, *hazardous location* classification requirements of ((~~NFPA 70~~)) the *Seattle Electrical Code* where the quantity of any Group A2, B2, A3 or B3 refrigerant in a single independent circuit would exceed 25 percent of the lower flammability limit (LFL) upon release to the space.
6. All refrigerant-containing parts in systems with a total connected compressor power exceeding 100 horsepower (hp) (74.6 kW)—except evaporators used for refrigeration or dehumidification, condensers used for heating, control and pressure relief valves for either, low-probability pumps and connecting piping—are located either outdoors or in a *machinery room*.

1104.3 Refrigerant restrictions. Refrigerant applications, maximum quantities and use shall be restricted in accordance with Sections 1104.3.1 through 1104.3.4.

1104.3.1 Air conditioning for human comfort. In other than industrial *occupancies* where the quantity in a single independent circuit does not exceed the amount in Table 1103.1, Group B1, B2 and B3 refrigerants shall not be used in high-probability systems for air conditioning for human comfort.

1104.3.2 Nonindustrial occupancies. Group A2 and B2 refrigerants shall not be used in high-probability systems where the quantity of refrigerant in any independent refrigerant circuit exceeds the amount shown in Table 1104.3.2. Group A3 and B3 refrigerants shall not be used except where *approved*.

Exception: This section does not apply to laboratories where the floor area per occupant is not less than 100 square feet (9.3 m^2).

TABLE 1104.3.2
MAXIMUM PERMISSIBLE QUANTITIES OF REFRIGERANTS

TYPE OF REFRIGERATION SYSTEM	MAXIMUM POUNDS FOR VARIOUS OCCUPANCIES			
	Institutional	Public assembly	Residential	All other occupancies
Sealed absorption system				
In exit access	0	0	3.3	3.3
In adjacent outdoor locations	0	0	22	22
In other than exit access	0	6.6	6.6	6.6
Unit systems				
In other than exit access	0	0	6.6	6.6

For SI: 1 pound = 0.454 kg.

1104.3.3 All occupancies. The total of all Group A2, B2, A3 and B3 refrigerants shall not exceed 1,100 pounds (499 kg) except where *approved*.

1104.3.4 Protection from refrigerant decomposition. Where any device having an open flame or surface temperature greater than 800°F (427°C) is used in a room containing more than 6.6 pounds (3 kg) of refrigerant in a single independent circuit, a hood and exhaust system shall be provided in accordance with Section 510. Such exhaust system shall exhaust *combustion* products to the outdoors.

Exception: A hood and exhaust system shall not be required where any of the following apply:

1. The refrigerant is R-718 (water) or R-744 (carbon dioxide).
2. The *combustion* air is ducted from the outdoors in a manner that prevents leaked refrigerant from being combusted.
3. A refrigerant detector is used to stop the *combustion* in the event of a refrigerant leak (see Sections 1105.3 and 1105.5).

1104.4 Volume calculations. Volume calculations shall be in accordance with Sections 1104.4.1 through 1104.4.3.

1104.4.1 Noncommunicating spaces. Where the refrigerant-containing parts of a system are located in one or more spaces that do not communicate through permanent openings or HVAC ducts, the volume of the smallest, enclosed occupied space shall be used to determine the permissible quantity of refrigerant in the system.

1104.4.2 Communicating spaces. Where an evaporator or condenser is located in an air duct system, the volume of the smallest, enclosed occupied space served by the duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

Exception: If airflow to any enclosed space cannot be reduced below one-quarter of its maximum, the entire space served by the air duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

[S] 1104.4.3 Plenums. Where the space above a suspended ceiling is continuous and part of the supply or return air *plenum* system, this space shall be included in calculating the volume of the enclosed space.

Interpretation: For variable refrigerant flow systems, the total allowable quantity of refrigerant in the system includes the refrigerant in the condensing unit, refrigerant controller, fan coil, and all associated piping.

SECTION 1105
MACHINERY ROOM, GENERAL REQUIREMENTS

[BF] 1105.1 Design and construction. *Machinery rooms* shall be designed and constructed in accordance with the *International Building Code* and this section.

1105.2 Openings. Ducts and air handlers in the *machinery room* that operate at a lower pressure than the room shall be sealed to prevent any refrigerant leakage from entering the airstream.

[S][F] 1105.3 Refrigerant ((~~detector~~)) detection system. ((~~Refrigerant detectors in *machinery rooms* shall be provided as required by Sections 608.9 and 608.18 of the *International Fire Code*.~~)) Refrigeration *machinery rooms* shall contain a refrigerant detection system with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values shown in this code for the refrigerant classification. Detectors and alarms shall be placed in *approved* locations. The detectors shall transmit a signal to an *approved* location.

1105.4 Tests. Periodic tests of the mechanical ventilating system shall be performed in accordance with manufacturer's specifications and as required by the code official.

1105.5 Fuel-burning appliances. Fuel-burning *appliances* and *equipment* having open flames and that use *combustion* air from the *machinery room* shall not be installed in a *machinery room*.

Exceptions:

1. Where the refrigerant is water (R-718) or carbon dioxide (R-744).
2. Fuel-burning *appliances* shall not be prohibited in the same *machinery room* with refrigerant-containing *equipment* or *appliances* where *combustion* air is ducted from outside the *machinery room* and sealed in such a manner as to prevent any refrigerant leakage from entering the *combustion* chamber, or where a refrigerant vapor detector is employed to automatically shut off the *combustion* process in the event of refrigerant leakage.

[S] 1105.6 Ventilation. *Machinery rooms* shall ((~~be mechanically ventilated~~)) have continuous mechanical ventilation to the outdoors.

Informative Note: The requirement for continuous mechanical ventilation to the outdoors means that fire dampers are not allowed on *machinery room* ventilation ducts.

Exception: Where a refrigerating system is located outdoors more than 20 feet (6096 mm) from any building opening and is enclosed by a penthouse, lean-to or other open structure, natural ((~~or mechanical~~)) ventilation shall be ((~~provided~~)) permitted. There shall be no openings to the building. Location of the openings shall be based on the relative density of the refrigerant to air. The free-aperture cross section for the ventilation of the *machinery room* shall be not less than:

$$F = \sqrt{G} \qquad \textbf{(Equation 11-1)}$$

For SI: $F = 0.138\sqrt{G}$

where:

F = The free opening area in square feet (m^2).

G = The mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the *machinery room*.

1105.6.1 Discharge location. The discharge of the air shall be to the outdoors in accordance with Chapter 5. Exhaust from mechanical ventilation systems shall be discharged not less than 20 feet (6096 mm) from a property line or openings into buildings.

1105.6.1.1 Indoor exhaust opening location. Indoor mechanical exhaust intake openings shall be located where refrigerant leakage is likely to concentrate based on the refrigerant's relative density to air, and the locations of the air current paths and refrigerating machinery.

1105.6.2 Makeup air. Provisions shall be made for *makeup air* to replace that being exhausted. Openings for *makeup air* shall be located to avoid intake of *exhaust air*. Supply and exhaust ducts to the *machinery room* shall not serve any other area, shall be constructed in accordance with Chapter 5 and shall be covered with corrosion-resistant screen of not less than 1/4-inch (6.4 mm) mesh.

1105.6.3 Ventilation rate. Mechanical ventilation systems shall be capable of exhausting the minimum quantity of air both at normal operating and emergency conditions, as required by Sections 1105.6.3.1 and 1105.6.3.2. Multiple fans or multi-speed fans shall be allowed to produce the emergency ventilation rate and to obtain a reduced airflow for normal ventilation.

[S] 1105.6.3.1 Quantity—normal ventilation. During occupied conditions, the mechanical ventilation system shall exhaust the larger of the following:

1. Not less than 0.5 cfm per square foot (0.0025 $m^3/s \cdot m^2$) of *machinery room* area. ((~~or 20 cfm (0.009 m^3/s) per person.~~))
2. A volume required to limit the room temperature rise to 18°F (10°C) taking into account the ambient heating effect of all machinery in the room.
3. Not less than 20 cfm (0.009 m^3/s) per *person.*

[S] 1105.6.3.1.1 Quantity—unoccupied condition. During unoccupied conditions, the mechanical ventilation system is permitted to exhaust the larger of the following:

1. Not less than 0.25 cfm per square foot (0.00125 $m^3/s \cdot m^2$) of *machinery room* area; or
2. A volume required to limit the room temperature rise to 18°F (10°C) taking into account the ambient heating effect of all machinery in the room.

The system shall be provided with controls that increase the ventilation to the rate required for occupied spaces when the space is illuminated.

1105.6.3.2 Quantity—emergency conditions. Upon actuation of the refrigerant detector required in Section 1105.3, the mechanical ventilation system shall *exhaust air* from the *machinery room* in the following quantity:

$$Q = 100 \times \sqrt{G} \qquad \textbf{(Equation 11-2)}$$

For SI: $Q = 0.07 \times \sqrt{G}$

where:

Q = The airflow in cubic feet per minute (m^3/s).

G = The design mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the *machinery room*.

[S][F] 1105.6.4 Standby source of power required. Where *mechanical ventilation*, treatment systems, temperature control, alarm, detection or other electrically operated systems are required, such systems shall be provided with a legally required standby source of power. See the *International Building Code* Chapter 27 and *Seattle Electrical Code* Article 701.

Exception: Legally required standby power is not required where an *approved* fail-safe engineered system is installed.

[S] 1105.7 Termination of relief devices. Pressure relief devices, fusible plugs and purge systems located within the *machinery room* shall terminate outside of the structure at a location not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, ventilation opening or exit.

Note: For additional requirements regarding termination of relief devices for flammable refrigerants, toxic and highly toxic refrigerants, treatment systems, and flaring systems, see Section 606 of the *International Fire Code*.

[F] 1105.8 Emergency pressure control system. Emergency pressure control systems shall be provided in accordance with Section 608.11 of the *International Fire Code*.

[BE] 1105.9 Means of egress. *Machinery rooms* larger than 1,000 square feet (93 m^2) shall have not less than two exits or exit access doorways. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of the room. All portions of *machinery rooms* shall be within 150 feet (45 720 mm) of an exit or exit access doorway. An increase in exit access travel distance is permitted in accordance with Section 1017.1 of the *International Building Code*. Exit and exit access doorways shall swing in the direction of egress travel and shall be equipped with panic hardware, regardless of the occupant load served. Exit and exit access doorways shall be tight fitting and self-closing.

SECTION 1106
MACHINERY ROOM, SPECIAL REQUIREMENTS

1106.1 General. Where required by Section 1104.2, the *machinery room* shall meet the requirements of this section in addition to the requirements of Section 1105.

1106.2 Elevated temperature. There shall not be an open flame-producing device or continuously operating hot surface over 800°F (427°C) permanently installed in the room.

1106.3 Flammable refrigerants. Where refrigerants of Groups A2, A3, B2 and B3 are used, the *machinery room* shall conform to the Class I, Division 2, *hazardous location* classification requirements of NFPA 70.

Exception: *Machinery rooms* for systems containing Group A2L *refrigerants* that are provided with ventilation in accordance with Section 1106.4.

1106.4 Special requirements for Group A2L refrigerant machinery rooms. *Machinery rooms* with systems containing Group A2L *refrigerants* that do not conform to the Class I, Division 2, hazardous location electrical requirements of NFPA 70, as permitted by the exception to Section 1106.3, shall comply with Sections 1106.4.1 through 1106.4.3.

Exception: *Machinery rooms* conforming to the Class I, Division 2, hazardous location classification requirements of NFPA 70 are not required to comply with Sections 1106.4.1 and 1106.4.2.

[F] 1106.4.1 Ventilation system activation. Ventilation shall be activated by the refrigerant detection system in the *machinery room*. Refrigerant detection systems shall be in accordance with Section 608.9 of the *International Fire Code* and all of the following:

1. The detectors shall activate at or below a refrigerant concentration of 25 percent of the LFL.
2. Upon activation, the detection system shall activate the emergency ventilation system required by Section 1106.4.2.
3. The detection, signaling and control circuits shall be supervised.

1106.4.2 Emergency ventilation system. An emergency ventilation system shall be provided at the minimum exhaust rate specified in ASHRAE 15 or Table 1106.4.2. Shutdown of the emergency ventilation system shall be by manual means.

[W] TABLE 1106.4.2
MINIMUM EXHAUST RATES

REFRIGERANT	Q(m/sec)	Q(cfm)
R32	15.4	32,600
R143A	13.6	28,700
R444A	6.46	13,700
R444B	10.6	22,400
R445A	7.83	16,600
R446A	23.9	50,700
R447A	23.8	50,400
R451A	7.04	15,000
R451B	7.05	15,000
R1234yf	7.80	16,600
R1234ze(E)	5.92	12,600

1106.4.3 Emergency ventilation system discharge. The emergency ventilation system point of discharge to the atmosphere shall be located outside of the structure at not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, *ventilation* opening or *exit*.

[F] 1106.5 Remote controls. Remote control of the mechanical *equipment* and *appliances* located in the *machinery room* shall comply with Sections 1106.5.1 and 1106.5.2.

[F] 1106.5.1 Refrigeration system emergency shutoff. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide off-only control of refrigerant compressors, refrigerant pumps, and normally closed, automatic refrigerant valves located in the *machinery room*. Additionally, this *equipment* shall be automatically shut off whenever the refrigerant vapor concentration in the *machinery room* exceeds the vapor detector's upper detection limit or 25 percent of the LEL, whichever is lower.

[F] 1106.5.2 Ventilation system. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide on-only control of the *machinery room* ventilation fans.

[F] 1106.6 Emergency signs and labels. Refrigeration units and systems shall be provided with *approved* emergency signs, charts, and labels in accordance with the *International Fire Code*.

[S][F] 1106.7 Alarm activation. Where continuous ventilation is provided, failure of the ventilation system shall automatically activate an audible and visual alarm.

SECTION 1107
PIPING MATERIAL

1107.1 Piping. Refrigerant piping material for other than R-717 (ammonia) systems shall conform to the requirements in this section. Piping material and installations for R-717 (ammonia) refrigeration systems shall comply with IIAR 2.

1107.2 Used materials. Used pipe, fittings, valves and other materials that are to be reused shall be clean and free from foreign materials and shall be approved for reuse.

1107.3 Materials rating. Materials, joints and connections shall be rated for the operating temperature and pressure of the refrigerant system. Materials shall be suitable for the type of refrigerant and type of lubricant in the refrigerant system. Magnesium alloys shall not be used in contact with any halogenated refrigerants. Aluminum, zinc, magnesium and their alloys shall not be used in contact with R-40 (methyl chloride).

1107.4 Piping materials standards. Refrigerant pipe shall conform to one or more of the standards listed in Table 1107.4. The exterior of the pipe shall be protected from corrosion and degradation.

[S] TABLE 1107.4
REFRIGERANT PIPE

PIPING MATERIAL	STANDARD
Aluminum tube	ASTM B210 ASTM B491/B491M
Brass (copper alloy) pipe	ASTM B43
Copper linesets	ASTM B280, ASTM B1003
Copper pipe	ASTM B42, ASTM B302
Copper tube[a]	ASTM B68, ASTM B75, ASTM B88, ASTM B280, ASTM B819
Steel pipe[b]	ASTM A53, ASTM A106
Steel tube	ASTM A254, ASTM A334

a. Soft annealed copper tubing larger than 1-3/8 inch (35 mm) O.D. shall not be used for field-assembled refrigerant piping unless it is protected from mechanical damage.

b. ASTM A53, ((~~Type F steel pipe shall not be used for~~)) refrigerant lines having an operating temperature less than -20°F (-29°C) shall be designed to meet the requirements of ASME B31.5, *Refrigeration Piping and Heat Transfer Components*.

1107.4.1 Steel pipe Groups A2, A3, B2 and B3. The minimum weight of steel pipe for Group A2, A3, B2 and B3 refrigerants shall be Schedule 80 for sizes 1-1/2 inches or less in diameter.

1107.5 Pipe fittings. Refrigerant pipe fittings shall be approved for installation with the piping materials to be installed, and shall conform to one of more of the standards *listed* in Table 1107.5 or shall be *listed* and *labeled* as complying with UL 207.

TABLE 1107.5
REFRIGERANT PIPE FITTINGS

FITTING MATERIAL	STANDARD
Aluminum	ASTM B361
Brass (copper alloy)	ASME B16.15, ASME B16.24
Copper	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.24, ASME B16.26, ASME B16.50
Steel	ASTM A105, ASTM A181, ASTM A193, ASTM A234, ASTM A420, ASTM A707

1107.5.1 Copper brazed field swaged. The minimum and maximum cup depth of field-fabricated copper brazed swaged fitting connections shall comply with Table 1107.5.1.

TABLE 1107.5.1
COPPER BRAZED SWAGED CUP DEPTHS

FITTING SIZE (inch)	MINIMUM DEPTH (inch)	MAXIMUM DEPTH (inch)
1/8	0.15	0.23
3/16	0.16	0.24
1/4	0.17	0.26
3/8	0.20	0.30
1/2	0.22	0.33
5/8	0.24	0.36
3/4	0.25	0.38
1	0.28	0.42
1-1/4	0.31	0.47
1-1/2	0.34	0.51
2	0.40	0.60
2-1/2	0.47	0.71
3	0.53	0.80
3-1/2	0.59	0.89
4	0.64	0.96

For SI: 1 inch = 25.4 mm.

1107.6 Valves. Valves shall be of materials that are compatible with the type of piping material, refrigerants and oils in the system. Valves shall be *listed* and *labeled* and rated for the temperatures and pressures of the refrigerant systems in which the valves are installed.

1109.8.2 Refrigerating systems containing more than 100 pounds (45 kg) of refrigerant. In addition to stop valves required by Section 1109.8.1, systems containing more than 100 pounds (45 kg) of refrigerant shall have stop valves installed in the following locations:

1. Each inlet of each liquid receiver.
2. Each inlet and each outlet of each condenser where more than one condenser is used in parallel.

Exceptions:

1. Stop valves shall not be required at the inlet of a receiver in a condensing unit nor at the inlet of a receiver that is an integral part of the condenser.
2. Systems utilizing nonpositive displacement compressors.

1109.8.3 Stop valve support. Stop valves shall be supported to prevent detrimental stress and strain on the refrigerant piping system. The piping system shall not be utilized to support stop valves on copper tubing or aluminum tubing 1 inch (25.4 mm) outside diameter or larger.

1109.8.4 Identification. Stop valves shall be identified where their intended purpose is not obvious. Where valves are identified by a numbering or lettering system, legend(s) or key(s) for the valve identification shall be located in the room containing the indoor refrigeration *equipment*. The minimum height of lettering of the identification label shall be 1/2 inch (12.7 mm).

SECTION 1110
REFRIGERATION PIPING SYSTEM TEST

1110.1 General. Refrigerant piping systems, other than R-717 (ammonia) refrigeration systems, that are erected in the field shall be pressure tested for strength and leak tested for tightness, in accordance with the requirements of this section, after installation and before being placed in operation. Tests shall include both the high- and low-pressure sides of each system.

Exception: *Listed* and *labeled equipment*, including compressors, condensers, vessels, evaporators, gas bulk storage tanks, safety devices, pressure gauges and control mechanisms, shall not be required to be tested.

[S] 1110.2 Exposure of refrigerant piping system. Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.

Exception: Factory-insulated piping line sets are exempt from exposing piping material for visual inspection.

1110.3 Test gases. The medium used for pressure testing the refrigerant system shall be one of the following inert gases: oxygen-free nitrogen, helium or argon. For R-744 refrigerant systems, carbon dioxide shall be allowed as the test medium. For R-718 refrigerant systems, water shall be allowed as the test medium. Oxygen, air, combustible gases and mixtures containing such gases shall not be used as a test medium. Systems erected on the premises with tubing not exceeding 5/8 inch (15.9 mm) outside diameter shall be allowed to use the refrigerant identified on the nameplate label or marking as the test medium.

1110.4 Test apparatus. The means used to pressurize the refrigerant piping system shall have on its outlet side a test pressure measuring device and either a pressure-limiting device or a pressure-reducing device. The test pressure measuring device shall have an accuracy of ±3 percent or less of the test pressure and shall have a resolution of 5 percent or less of the test pressure.

1110.5 Piping system pressure test and leak test. The refrigerant piping system shall be tested as a whole or separate tests shall be conducted for the low-pressure side and high-pressure side of the piping system. The refrigerant piping system shall be tested in accordance with both of the following methods:

1. The system shall be pressurized for a period of not less than 60 minutes to not less than the lower of the design pressures or the setting of the pressure relief device(s). The design pressures for testing shall be the pressure *listed* on the label nameplate of the condensing unit, compressor, compressor unit, pressure vessel or other system component with a nameplate. Additional test gas shall not be added to the system after the start of the pressure test. The system shall not show loss of pressure on the test pressure measuring device during the pressure test. Where using refrigerant as a test medium in accordance with Section 1110.3, the test pressure shall be not less than the saturation dew point pressure at 77°F (25°C).
2. A vacuum of 500 microns shall be achieved. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise above 1,500 microns for a period of not less than 10 minutes.

1110.5.1 Joints and refrigerant-containing parts in air ducts. Joints and all refrigerant-containing parts of a refrigerating system located in an air duct of an air-conditioning system that conveys conditioned air to and from human-occupied spaces shall be tested at a pressure of 150 percent of the higher of the design pressure or pressure relief device setting.

1110.5.2 Limited charge systems. Limited charge systems with a pressure relief device, erected on the premises, shall be tested at a pressure not less than one and one-half times the pressure setting of the relief device. *Listed* and *labeled* limited charge systems shall be tested at the *equipment* or *appliance* design pressure.

CHAPTER 12

HYDRONIC PIPING

User note:

About this chapter: *Chapter 12 addresses the piping systems used in heating and cooling systems. Such piping typically conveys water, water and antifreeze solutions, steam and condensate. The fluids conveyed are heated or cooled by boilers, chillers and heat pumps, which are all components of HVAC systems.*

SECTION 1201
GENERAL

[S] 1201.1 Scope. The provisions of this chapter shall govern the construction, installation, *alteration* and repair of hydronic piping systems. This chapter shall apply to hydronic piping systems that are part of heating, ventilation and air-conditioning systems. Such piping systems shall include steam, hot water, chilled water, steam condensate and ground source heat pump loop systems. Potable cold and hot water distribution systems shall be installed in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

1201.2 Sizing. Piping and piping system components for hydronic systems shall be sized for the demand of the system.

1201.3 Standards. As an alternative to the provisions of Sections 1202 and 1203, piping shall be designed, installed, inspected and tested in accordance with ASME B31.9.

SECTION 1202
MATERIAL

1202.1 Piping. Piping material shall conform to the standards cited in this section.

Exception: Embedded piping regulated by Section 1209.

1202.2 Used materials. Reused pipe, fittings, valves or other materials shall be clean and free from foreign materials and shall be *approved* by the code official for reuse.

1202.3 Material rating. Materials shall be rated for the operating temperature and pressure of the hydronic system. Materials shall be suitable for the type of fluid in the hydronic system.

1202.4 Piping materials standards. Hydronic pipe shall conform to the standards listed in Table 1202.4. The exterior of the pipe shall be protected from corrosion and degradation.

TABLE 1202.4
HYDRONIC PIPE

MATERIAL	STANDARD (see Chapter 15)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D1527; ASTM F2806
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D2846; ASTM F441; ASTM F442
Chlorinated polyvinyl chloride/aluminum/chlorinated polyvinyl chloride (CPVC/AL/CPVC)	ASTM F2855
Copper or copper-alloy pipe	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tube (Type K, L or M)	ASTM B75; ASTM B88; ASTM B135; ASTM B251
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe	ASTM F1281; CSA CAN/CSA-B-137.10
Cross-linked polyethylene (PEX) tubing	ASTM F876; ASTM F3253; CSA B137.5
Ductile iron pipe	AWWA C115/A21.15; AWWA C151/A21.51
Lead pipe	FS WW-P-325B
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; CSA B137.9
Polypropylene (PP) plastic pipe	ASTM F2389
Polyvinyl chloride (PVC) plastic pipe	ASTM D1785; ASTM D2241
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18

SECTION 1205
VALVES

1205.1 Where required. Shutoff valves shall be installed in hydronic piping systems in the locations indicated in Sections 1205.1.1 through 1205.1.6.

1205.1.1 Heat exchangers. Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shutoff valves shall not be required where heat exchangers are integral with a boiler; or are a component of a manufacturer's boiler and heat exchanger packaged unit and are capable of being isolated from the hydronic system by the supply and return valves required by Section 1005.1.

1205.1.2 Central systems. Shutoff valves shall be installed on the building supply and return of a central utility system.

1205.1.3 Pressure vessels. Shutoff valves shall be installed on the connection to any pressure vessel.

1205.1.4 Pressure-reducing valves. Shutoff valves shall be installed on both sides of a pressure-reducing valve.

1205.1.5 Equipment and appliances. Shutoff valves shall be installed on connections to mechanical *equipment* and *appliances*. This requirement does not apply to components of a hydronic system such as pumps, air separators, metering devices and similar *equipment*.

1205.1.6 Expansion tanks. Shutoff valves shall be installed at connections to nondiaphragm-type expansion tanks.

1205.2 Reduced pressure. A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section 1006.

SECTION 1206
PIPING INSTALLATION

1206.1 General. Piping, valves, fittings and connections shall be installed in accordance with the conditions of approval.

[S] 1206.2 System drain down. Hydronic piping systems shall be designed and installed to permit the system to be drained. Where the system drains to the plumbing drainage system, the installation shall conform to the requirements of the ((~~*International*~~)) *Uniform Plumbing Code*.

Exception: The buried portions of systems embedded underground or under floors.

[S] 1206.3 Protection of potable water. The potable water system shall be protected from backflow in accordance with the ((~~*International*~~)) *Uniform Plumbing Code*.

1206.4 Pipe penetrations. Openings for pipe penetrations in walls, floors or ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with the *International Building Code*.

1206.5 Clearance to combustibles. A pipe in a hydronic piping system in which the exterior temperature exceeds 250°F (121°C) shall have a minimum *clearance* of 1 inch (25 mm) to combustible materials.

1206.6 Contact with building material. A hydronic piping system shall not be in direct contact with building materials that cause the piping material to degrade or corrode, or that interfere with the operation of the system.

1206.7 Water hammer. The flow velocity of the hydronic piping system shall be controlled to reduce the possibility of water hammer. Where a quick-closing valve creates water hammer, an *approved* water-hammer arrestor shall be installed. The arrestor shall be located within a range as specified by the manufacturer of the quick-closing valve.

1206.8 Steam piping pitch. Steam piping shall be installed to drain to the boiler or the steam trap. Steam systems shall not have drip pockets that reduce the capacity of the steam piping.

1206.9 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

1206.9.1 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the *design flood elevation*.

1206.10 Pipe support. Pipe shall be supported in accordance with Section 305.

1206.11 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of piping.

SECTION 1207
TRANSFER FLUID

1207.1 Flash point. The flash point of transfer fluid in a hydronic piping system shall be not less than 50°F (28°C) above the maximum system operating temperature.

1207.2 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

SECTION 1208
TESTS

1208.1 General. Hydronic piping systems shall be tested hydrostatically at one and one-half times the maximum system design pressure, but not less than 100 psi (689 kPa). The duration of each test shall be not less than 15 minutes.

Exception: For PEX piping systems, testing with a compressed gas shall be an alternative to hydrostatic testing where compressed air or other gas pressure testing is specifically authorized by all of the manufacturers' instructions for the PEX pipe and fitting products installed at the time the system is being tested, and compressed air or other gas testing is not otherwise prohibited by applicable codes, laws or regulations outside of this code.

SECTION 1209
EMBEDDED PIPING

1209.1 Materials. Piping for heating panels shall be standard-weight steel pipe, Type L copper tubing, polybutylene or other *approved* plastic pipe or tubing rated at 100 psi (689 kPa) at 180°F (82°C).

1209.2 Pressurizing during installation. Piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

1209.3 Embedded joints. Joints of pipe or tubing that are embedded in a portion of the building, such as concrete or plaster, shall be in accordance with the requirements of Sections 1209.3.1 through 1209.3.5.

1209.3.1 Steel pipe joints. Steel pipe shall be welded by electrical arc or oxygen/acetylene method.

1209.3.2 Copper tubing joints. Copper tubing shall be joined by brazing complying with Section 1203.3.1.

1209.3.3 Polybutylene joints. Polybutylene pipe and tubing shall be installed in continuous lengths or shall be joined by heat fusion in accordance with Section 1203.9.1.

1209.3.4 Polyethylene of raised temperature (PE-RT) joints. PE-RT tubing shall be installed in continuous lengths or shall be joined by hydronic fittings listed in Table 1202.5.

1209.3.5 Cross-linked polyethylene (PEX) joints. PEX tubing shall be installed in continuous lengths or shall be joined by hydronic fittings listed in Table 1202.5.

1209.4 Not embedded related piping. Joints of other piping in cavities or running exposed shall be joined by *approved* methods in accordance with manufacturer's installation instructions and related sections of this code.

[W][S] 1209.5 Insulation and thermal break required. Radiant floor heating and snow melt systems shall be provided with insulation and a thermal break in accordance with Sections 1209.5.1 and 1209.5.2. Concrete slab-on-grade, asphalt and paver-system type pavements shall have a minimum of R-10 insulation installed under the area to be snow melted, or R-5 insulation shall be installed under and at the slab edges of the area to be snow melted. The insulation shall be located underneath the snow and ice melt hydronic piping or cable and along all edges of the pavement where the snow and ice melt system is installed in accordance with the snow and ice melt manufacturer's instructions. Insulation *R*-values for slab-on-grade and suspended floor installation shall be in accordance with the ((~~*International Energy Conservation Code*~~)) *Seattle Energy Code*.

((**~~Exception:~~** ~~Insulation shall not be required in engineered systems where it can be demonstrated that the insulation will decrease the efficiency or have a negative effect on the installation.~~))

1209.5.1 ((~~Thermal break required~~)) Slab-on-grade insulation. ((~~A thermal break shall be provided consisting of asphalt expansion joint materials or similar insulating materials at a point where a heated slab meets a foundation wall or other conductive slab.~~)) Radiant piping utilized in slab-on-grade applications shall be provided with insulating materials installed beneath the piping as required by the Washington State Energy Code.

1209.5.2 Insulation material marking. Insulating materials utilized in radiant floor heating systems shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

[S] 1210.7.6 Expansion tanks. Shutoff valves shall be installed at connections to ((~~nondiaphragm-type~~)) expansion tanks. A method of draining the expansion tank downstream of the shutoff valve shall be provided.

1210.7.7 Reduced pressure. A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section 1006.

1210.8 Installation. Piping, valves, fittings and connections shall be installed in accordance with ANSI/CSA/IGSHPA C448 and the manufacturer's instructions.

1210.8.1 Protection of potable water. Where ground-source heat pump ground-loop systems have a connection to a potable water supply, the potable water system shall be protected from backflow in accordance with the *International Plumbing Code*.

1210.8.2 Pipe penetrations. Openings for pipe penetrations in walls, floors and ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with the *International Building Code*.

1210.8.3 Clearance from combustibles. A pipe in a ground-source heat pump piping system having an exterior surface temperature exceeding 250°F (121°C) shall have a minimum *clearance* of 1 inch (25 mm) from combustible materials.

1210.8.4 Contact with building material. A ground-source heat pump ground-loop piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interfere with the operation of the system.

1210.8.5 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

1210.8.6 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the *design flood elevation*.

1210.8.7 Pipe support. Pipe shall be supported in accordance with Section 305.

1210.8.8 Velocities. Ground-source heat pump ground-loop systems shall be designed so that the flow velocities do not exceed the maximum flow velocity recommended by the pipe and fittings manufacturer and shall be controlled to reduce the possibility of water hammer.

1210.8.9 Labeling and marking. Ground-source heat pump ground-loop system piping shall be marked with tape, metal tags or other method where it enters a building indicating "GROUND-SOURCE HEAT PUMP LOOP SYSTEM." The marking shall indicate any antifreeze used in the system by name and concentration.

1210.8.10 Chemical compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings and mechanical systems.

1210.9 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

1210.10 Tests. Before connection header trenches are backfilled, the assembled loop system shall be pressure tested with water at 100 psi (689 kPa) for 15 minutes, in which time there shall not be observed leaks. Flow and pressure loss testing shall be performed and the actual flow rates and pressure drops shall be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10 percent, the cause shall be identified and corrective action taken.

1210.11 Embedded piping. Ground-source heat pump ground-loop piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

CHAPTER 13
FUEL OIL PIPING AND STORAGE

User note:

About this chapter: *Chapter 13 is devoted to fuel oil piping and fuel oil storage related to heating appliances, power generators and similar equipment/appliances. The requirements focus on preventing fuel leaks and equipment failures that could result in severe fire hazards.*

SECTION 1301
GENERAL

1301.1 Scope. This chapter shall govern the design, installation, construction and repair of fuel oil storage and piping systems. The storage of fuel oil and flammable and combustible liquids shall be in accordance with Chapters 6 and 57 of the *International Fire Code*.

[S] 1301.2 Storage and piping systems. Fuel oil storage systems shall comply with Section ((~~603.3~~)) 605.4 of the *International Fire Code*. Fuel oil piping systems shall comply with the requirements of this code.

1301.3 Fuel type. An *appliance* shall be designed for use with the type of fuel to which it will be connected. Such *appliance* shall not be converted from the fuel specified on the rating plate for use with a different fuel without securing reapproval from the code official.

1301.4 Fuel tanks, piping, fittings and valves. The tank, piping, fittings and valves for *appliances* burning oil shall be installed in accordance with the requirements of this chapter. Where an oil burner is served by a tank, any part of which is above the level of the burner inlet connection and where the fuel supply line is taken from the top of the tank, an *approved* antisiphon valve or other siphon-breaking device shall be installed in lieu of the shutoff valve.

1301.5 Tanks abandoned or removed. All exterior above-grade fill piping shall be removed when tanks are abandoned or removed. Tank abandonment and removal shall be in accordance with Section 5704.2.13 of the *International Fire Code*.

SECTION 1302
MATERIAL

1302.1 General. Piping materials shall conform to the standards cited in this section.

1302.2 Rated for system. All materials shall be rated for the operating temperatures and pressures of the system, and shall be compatible with the type of liquid.

1302.3 Pipe standards. Fuel oil pipe shall comply with one of the standards listed in Table 1302.3.

TABLE 1302.3
FUEL OIL PIPING AND FITTINGS

MATERIAL	STANDARD (see Chapter 15)
Copper or copper-alloy pipe and fittings	ASTM B42; ASTM B43; ASTM B302; ASTM F3226
Copper or copper-alloy tubing and fittings (Type K, L or M)	ASME B16.51; ASTM B75; ASTM B88; ASTM B280; ASTM F3226
Labeled pipe	(See Section 1302.4)
Nonmetallic pipe	ASTM D2996
Steel and stainless steel pipe and fittings	ASTM A53; ASTM A106; A312/A312M; ASTM F3226
Steel and stainless steel tubing and fittings	ASTM A254; A269/A269M; ASTM A539; ASTM F3226

1302.4 Nonmetallic pipe. Nonmetallic pipe shall be *listed* and *labeled* as being acceptable for the intended application for flammable and combustible liquids. Nonmetallic pipe shall be installed only outdoors, underground.

1302.5 Fittings and valves. Fittings and valves shall be *approved* for the piping systems, and shall be compatible with, or shall be of the same material as, the pipe or tubing.

1302.6 Bending of pipe. Pipe shall be *approved* for bending. Pipe bends shall be made with *approved equipment*. The bend shall not exceed the structural limitations of the pipe.

1302.7 Pumps. Pumps that are not part of an *appliance* shall be of a positive-displacement type. The pump shall automatically shut off the supply when not in operation. Pumps shall be *listed* and *labeled* in accordance with UL 343.

SECTION 1305
FUEL OIL SYSTEM INSTALLATION

1305.1 Size. The fuel oil system shall be sized for the maximum capacity of fuel oil required. The minimum size of a supply line shall be 3/8-inch (9.5 mm) inside diameter nominal pipe or 3/8-inch (9.5 mm) outside diameter tubing. The minimum size of a return line shall be 1/4-inch (6.4 mm) inside diameter nominal pipe or 5/16-inch (7.9 mm) outside diameter tubing. Copper tubing shall have 0.035-inch (0.9 mm) nominal and 0.032-inch (0.8 mm) minimum wall thickness.

1305.2 Protection of pipe, equipment and appliances. Fuel oil pipe, *equipment* and *appliances* shall be protected from physical damage.

1305.2.1 Flood hazard. Fuel oil pipe, *equipment* and *appliances* located in flood hazard areas shall be located above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment or shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

1305.3 Supply piping. Supply piping shall connect to the top of the fuel oil tank. Fuel oil shall be supplied by a transfer pump or automatic pump or by other *approved* means.

Exception: This section shall not apply to inside or above-ground fuel oil tanks.

1305.4 Return piping. Return piping shall connect to the top of the fuel oil tank. Valves shall not be installed on return piping.

1305.5 System pressure. The system shall be designed for the maximum pressure required by the fuel-oil-burning *appliance*. Air or other gases shall not be used to pressurize tanks.

1305.6 Fill piping. A fill pipe shall terminate outside of a building at a point not less than 2 feet (610 mm) from any building opening at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Fill opening shall be equipped with a tight metal cover designed to discourage tampering.

[W] 1305.7 Vent piping. Liquid fuel vent pipes shall terminate outside of buildings at a point not less than ((~~2 feet (610 mm)~~)) 5 feet measured ((~~vertically or horizontally~~)) from any building opening. Outer ends of vent pipes shall terminate in a weatherproof vent cap or fitting or be provided with a weatherproof hood. Vent caps shall have a minimum free open area equal to the cross-sectional area of the vent pipe and shall not employ screens finer than No. 4 mesh. Vent pipes shall terminate sufficiently above the ground to avoid being obstructed with snow or ice. Vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused. If the static head with a vent pipe filled with oil exceeds 10 pounds per square inch (psi) (69 kPa), the tank shall be designed for the maximum static head that will be imposed.

Liquid fuel vent pipes shall not be cross connected with fill pipes, lines from burners or overflow lines from auxiliary tanks.

Exception: Liquid fuel vent pipes may terminate outside the building at a point not less than 2 feet from the fuel oil equipment combustion exhaust outlet.

SECTION 1306
OIL GAUGING

1306.1 Level indication. Tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with a method of determining the oil level.

1306.2 Test wells. Test wells shall not be installed inside buildings. For outdoor service, test wells shall be equipped with a tight metal cover designed to discourage tampering.

1306.3 Inside tanks. The gauging of inside tanks by means of measuring sticks shall not be permitted. An inside tank provided with fill and vent pipes shall be provided with a device to indicate either visually or audibly at the fill point when the oil in the tank has reached a predetermined safe level.

1306.4 Gauging devices. Gauging devices such as liquid level indicators or signals shall be designed and installed so that oil vapor will not be discharged into a building from the liquid fuel supply system. Liquid-level indicating gauges shall comply with UL 180.

1306.5 Gauge glass. A tank used in connection with any oil burner shall not be equipped with a glass gauge or any gauge that, when broken, will permit the escape of oil from the tank.

SECTION 1307
FUEL OIL VALVES

1307.1 Building shutoff. A shutoff valve shall be installed on the fuel-oil supply line at the entrance to the building. Inside or above-ground tanks are permitted to have valves installed at the tank. The valve shall be capable of stopping the flow of fuel

CHAPTER 14
SOLAR THERMAL SYSTEMS

User note:

About this chapter: *Chapter 14 addresses solar thermal systems, not photovoltaic systems. The provisions are intended to protect property and life from the hazards associated with high-temperature liquids, pressurized systems and toxic fluids. There are also provisions to protect the building structure and the solar thermal system components from damage.*

SECTION 1401
GENERAL

[S] 1401.1 Scope. This chapter shall govern the design, construction, installation, *alteration* and repair of solar thermal systems, *equipment* and *appliances* intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating. Photovoltaic solar systems shall be installed in accordance with the *International Building Code* and Article 690 of the *Seattle Electrical Code*. Systems interconnected to the electric grid shall comply with additional requirements of Seattle City Light.

Note: See the *Seattle Boiler and Pressure Vessel Code* for regulations applicable to boilers and pressure vessels, and the *Seattle Plumbing Code* for regulations applicable to water heaters.

[S] 1401.2 Potable water supply. Potable water supplies to solar systems shall be protected against contamination in accordance with the ((~~*International*~~)) *Seattle Plumbing Code*.

Exception: Where all solar system piping is a part of the potable water distribution system, in accordance with the requirements of the ((~~*International*~~)) *Seattle Plumbing Code*, and all components of the piping system are *listed* for potable water use, cross-connection protection measures shall not be required.

1401.3 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be *approved* for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1401.4 Solar thermal equipment and appliances. Solar thermal *equipment* and *appliances* shall conform to the requirements of this chapter and ICC 900/SRCC 300. Solar thermal systems shall be *listed* and *labeled* in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1401.4.1 Collectors and panels. Solar thermal collectors and panels shall be *listed* and *labeled* in accordance with ICC 901/SRCC 100.

SECTION 1402
DESIGN AND INSTALLATION

1402.1 General. The design and installation of solar thermal systems shall comply with Sections 1402.1 through 1402.8. Solar thermal systems shall be *listed* and *labeled* in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1402.2 Access. Access shall be provided to solar thermal *equipment* for maintenance. Solar thermal systems and appurtenances shall not obstruct or interfere with the operation of any doors, windows or other building components requiring operation or access. Roof-mounted solar thermal *equipment* shall not obstruct or interfere with the operation of roof-mounted *equipment*, *appliances*, chimneys, roof hatches, smoke vents, skylights and other roof penetrations and openings.

1402.3 Pressure and temperature. Solar thermal system components containing pressurized fluids shall be protected against pressures and temperatures exceeding design limitations with pressure and temperature relief valves or pressure relief valves. System components shall have a working pressure rating of not less than the setting of the pressure relief device.

[S] 1402.3.1 Relief device. Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of ((~~Section 1006.6~~)) the *Seattle Boiler and Pressure Vessel Code*. For indirect solar systems, pressure relief valves in solar loops shall also comply with ICC 900/SRCC 300.

1402.3.2 Vacuum. System components that might be subjected to a vacuum while in operation or during shutdown shall be designed to withstand such vacuum or shall be protected with vacuum relief valves.

[S] 1402.8.3 Piping. Potable piping shall be installed in accordance with the *International Plumbing Code*. Hydronic piping shall be installed in accordance with Chapter ((~~10~~)) 12 of this code. Mechanical system piping shall be supported in accordance with Section 305.

1402.8.3.1 Piping insulation. Piping shall be insulated in accordance with the requirements of the *International Energy Conservation Code*. Exterior insulation shall be protected from degradation. The entire solar loop shall be insulated. Where split-style insulation is used, the seam shall be sealed. Fittings shall be fully insulated. Insulation shall comply with Section 1204.1.

Exceptions:

1. Those portions of the piping that are used to help prevent the system from overheating shall not be required to be insulated.
2. Those portions of piping that are exposed to solar radiation, made of the same material as the solar collector absorber plate and covered in the same manner as the solar collector absorber, or that are used to collect additional solar energy, shall not be required to be insulated.
3. Piping in solar thermal systems using unglazed solar collectors to heat a swimming pool shall not be required to be insulated.

1402.8.4 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be approved for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1402.8.4.1 Double-wall heat exchangers. Heat exchangers utilizing a nonfood-grade fluid shall be separated from the potable water by double-wall construction. An air gap open to the atmosphere shall be provided between the two walls. The discharge location from the double-wall heat exchanger shall be visible.

1402.8.4.2 Single-wall heat exchangers. Food-grade fluids shall be used as the heat transfer fluid in singlewall heat exchangers.

1402.8.5 Water heaters and hot water storage tanks. Auxiliary water heaters, boilers and water storage tanks associated with solar thermal systems shall comply with Chapter 10 and ICC 900/SRCC 300.

1402.8.5.1 Hot water storage tank insulation. Hot water storage tanks shall be insulated and such insulation shall have an *R*-value of not less than R-12.5.

1402.8.5.2 Outdoor locations. Storage tanks and heating *equipment* installed in outdoor locations shall be designed for outdoor installation.

1402.8.5.3 Storage tank sensors. Storage tank sensors shall comply with ICC 900/SRCC 300.

1402.8.6 Solar loop. Solar loops shall be in accordance with Sections 1402.8.6.1 and 1402.8.6.2.

1402.8.6.1 Solar loop isolation. Valves shall be installed to allow the solar loop to be isolated from the remainder of the system.

1402.8.6.2 Drain and fill valve caps. Drain caps shall be installed on drain and fill valves.

[S] 1402.8.7 Expansion tanks. Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with ((~~Section 1009~~)) the *Seattle Boiler and Pressure Vessel Code*, except that additional expansion tank acceptance volume equal to the total volume of liquid contained in the installed solar collectors and piping above the collectors shall be included.

SECTION 1403
HEAT TRANSFER FLUIDS

1403.1 Flash point. The flash point of the heat transfer fluid utilized in a solar system shall be not less than 50°F (28°C) above the design maximum nonoperating (no-flow) temperature of the fluid attained in the collector.

1403.2 Heat transfer fluids. Heat transfer gases and liquids shall be rated to withstand the system's maximum design temperature under operating conditions without degradation. Heat transfer fluids shall be in accordance with ICC 900/SRCC 300.

1403.3 Food-grade additives. Any food-grade fluid used as a heat transfer fluid containing additives shall be third-party listed by an approved agency to the appropriate section of the Code of Federal Regulations, Title 21, Food and Drugs, Chapter 1, Food and Drug Administration, Parts 174–186.

1403.4 Toxicity. The use of toxic fluids shall comply with Title 15 of the Federal Hazardous Substances Act and Chapter 60 of the *International Fire Code*.

CHAPTER 15
REFERENCED STANDARDS

User note:

About this chapter: *This code contains numerous references to standards that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard. This chapter lists the standards that are referenced in various sections of this document.*

The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section ((~~102.8~~)) 103.5.

ACCA

Air Conditioning Contractors of America
2800 Shirlington Road, Suite 300
Arlington, VA 22206

ANSI/ACCA 1 Manual D—2016: Residential Duct Systems
601.4, 603.2

ANSI/ACCA 10 Manual SPS—2010 (RA 2017): HVAC Design for Swimming Pools and Spas
403.2.1

ANSI/ASHRAE/ACCA 183—2007 (reaffirmed 2014): Peak Cooling and Heating Load Calculations in Buildings Except Low-rise Residential Buildings
312.1

AHAM

AHAM Association of Home Appliance Manufacturers
1111 19th St. N.W., #402
Washington, D.C. 20036

[W] AHAM-Certified Range Hood Directory
403.4.7.3.1

[W] HRH-2 Household Range Hoods
403.4.7.3.1

AHRI

Air-Conditioning, Heating & Refrigeration Institute
2311 Wilson Blvd., Suite 400
Arlington, VA 22201

700—2017: with Addendum 1: Specifications for Refrigerants
1102.2.2.3

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004

230—15: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification
930.1

ANSI/AMCA 210—16/ANSI/ASHRAE 51—16: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
403.3.2.5

ANSI/AMCA 550—15 (Rev. 09/18): Test Method for High Velocity Wind Driven Rain Resistant Louvers
401.5, 501.3.2

ANCE

[W] UL/CSA/ANCE 60335-2-40-2019 Household and Similar Electrical Appliances—Safety—Part 2-40: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers
Table 1101.2

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

ANSI Z21.1—2016/CSA 1.1—2016: Household Cooking Gas Appliances
505.2

Z21.8—1994 (R2017): Installation of Domestic Gas Conversion Burners
919.1

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329

15—2019: Safety Standard for Refrigeration Systems
1101.6, 1105.8, 1108.1

34—2019: Designation and Safety Classification of Refrigerants
202, 1102.2.1, 1103.1

62.1—2019: Ventilation for Acceptable Indoor Air Quality
401.2, 403.3.1.1.2.3.2

[W] 62.2—2019: Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
401.4, 403.4, 403.4.7.3.3, 403.4.11

90.1—2016: Energy Standard for Buildings Except Low-rise Residential Buildings
401.2

170—2017: Ventilation of Health Care Facilities
407

180—2018: Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
102.3

ANSI/AMCA 210–ANSI/ASHRAE 51—16: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
403.3.2.4

ASHRAE—2017: ASHRAE Handbook of Fundamentals
603.2

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

A112.4.1—2009 (R2019): Water Heater Relief Valve Drain Tubes
1006.6

B1.1—2003: Unified Inch Screw Threads, UN and UNR Thread Form
1108.3.4

B1.13M—2006: Metric Screw Threads: M Profile
1108.3.4

B1.20.1—2013(R2018): Pipe Threads, General Purpose (Inch)
1203.3.5, 1303.3.3

B1.20.3—1976: Dryseal Pipe Threads, Inch
1108.3.4

B16.3—2016: Malleable Iron Threaded Fittings, Classes 150 & 300
Table 1202.5

ASME—continued

B16.5—2017: Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24
Table 1202.5

B16.9—2019: Factory-made Wrought Steel Buttwelding Fittings
Table 1202.5

B16.11—2016: Forged Fittings, Socket-welding and Threaded
Table 1202.5

B16.15—2018: Cast Alloy Threaded Fittings: Classes 125 and 250
Table 1202.5

B16.18—2018: Cast Copper Alloy Solder Joint Pressure Fittings
513.13.1, Table 1202.5

B16.22—2018: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
513.13.1, Table 1202.5

B16.24—2016: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500
Table 1202.5

B16.26—2018: Cast Copper Alloy Fittings for Flared Copper Tubes
Table 1202.5

B16.28—1994: Wrought Steel Buttwelding Short Radius Elbows and Returns
Table 1202.5

B16.50—2018: Wrought Copper and Copper Alloy Braze-joint Pressure Fittings
Table 1107.5

B16.51—2018: Copper and Copper Alloy Press-connect Pressure Fittings
Table 1202.5

B31.5—2010: Refrigeration Piping and Heat Transfer Components
1107.5.1

B31.5—2019: Refrigeration Piping and Heat Transfer Components
1107.1

B31.9—2020: Building Services Piping
1201.3

((~~**BPVC—2019: ASME Boiler & Pressure Vessel Code—07 Edition**~~
~~1003.1, 1004.1, 1009.2, 1011.1~~))

((~~**CSD-1—2018: Controls and Safety Devices for Automatically Fired Boilers**~~
~~1004.1~~))

ASSE

ASSE International
18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448

1017—2009: Performance Requirements for Temperature Actuated Mixing Values for Hot Water Distribution Systems
1002.2.2

1061—2015: Performance Requirements for Push Fit Fittings
Table 1202.5

1079—2005: Performance Requirements for Dielectric Pipe Unions
1108.1.1

ASSP

American Society of Safety Professionals
520 N. Northwest Highway
Park Ridge, IL 60068

ANSI/ASSP Z359.1—2020: The Fall Protection Code
304.11

ASTM—continued

D2564—2012(2018): Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
1203.3.4

D2657—2007(2015): Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
Table 1210.5

D2683—14: Specification for Socket-type Polyethylene Fittings for Outside Diameter-controlled Polyethylene Pipe and Tubing
Table 1210.5, 1210.6.6.1

D2737—12a: Standard Specification for Polyethylene (PE) Plastic Tubing
Table 1210.4

D2846/D2846M—2017BE1: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems
Table 1202.4, Table 1202.5, 1203.3.4, Table 1210.4

D2996—2017: Specification for Filament-wound Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe
Table 1302.3

D3035—15: Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
Table 1210.4

D3261—2016: Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
Table 1210.5, 1210.6.6.1

D3278—96(2011): Test Methods for Flash Point of Liquids by Small Scale Closed-cup Apparatus
202

D3309—96a(2002): Specification for Polybutylene (PB) Plastic Hot- and Cold-water Distribution Systems
Table 1202.4

E84—2018B: Standard Test Method for Surface Burning Characteristics of Building Materials
202, 510.8, 602.2, 602.2.1, 602.2.1.6, 602.2.1.7, 604.3, 1204.1

E119—2018B: Test Method for Fire Tests of Building Construction and Materials
607.2.1, 607.5.2, 607.5.5, 607.6.1

E136—2019: Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
202

E814—2013A(2017): Standard Test Method for Fire Tests of Penetration Firestop Systems
506.3.11.2, 506.3.11.3

E1509—2012(2017): Specification for Room Heaters, Pellet Fuel-burning Type
904.1

E2231—2018: Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
604.3, 1204.1

E2336—16: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
506.3.6, 506.3.11.2

[W] E3087-18: Standard Test Method for Measuring Capture Efficiency of Domestic Range Hoods
403.4.7.3.2, Table 403.4.7.3.2

F437—15: Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
Table 1210.5

F438—2017: Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
Table 1202.5, Table 1210.5

F439—13: Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
Table 1202.5, Table 1210.5

F441/F441M—15: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
Table 1202.4, Table 1210.4

F442/F442M—13e1: Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
Table 1202.4, Table 1210.4

F493—14: Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
1203.3.4

F714—13: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
Table 1210.4

CSA—continued

B137.9—17: Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-pipe Systems
Table 1202.4, Table 1210.4, Table 1210.5

B137.10—17: Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure-pipe Systems
Table 1202.4

B137.11—17: Polypropylene (PP-R) Pipe and Fittings for Pressure Applications
Table 1210.4, Table 1210.5

B137.18—17: Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications
Table 1202.4, Table 1202.5, Table 1210.5

C22.2 No. 218.1—13(R2017): Spas, Hot Tubs and Associated Equipment
916.1

C22.2 No. 236—15: Heating and Cooling Equipment
916.1

DOL

U.S. Department of Labor Occupational Safety and Health Administration
c/o Superintendent of Documents U.S. Government Printing Office
Washington, DC 20402-9325

29 CFR Part 1910.1000 (2015): Air Contaminants
502.6

29 CFR Part 1910.1025 (2015): Toxic and Hazardous Substances
502.19

FDA

U.S. Food and Drug Administration
10903 New Hampshire Avenue
Silver Springs, MD 20993

FDA Title 15: Federal Hazardous Substances Act
1403.4

FDA Title 21: Code of Federal Regulations, Title 21, Food and Drugs, Chapter 1, Food and Drug Administration, Parts 174–186 (revised as of April 1, 2015)
1403.3

FS

Federal Specifications* General Services Administration
7th & D Streets Specification Section, Room 6039
Washington, DC 20407

WW-P-325B (1976): Pipe, Bends, Traps, Caps and Plugs; Lead (for Industrial Pressure and Soil and Waste Applications)
Table 1202.4

*Standards are available from the Supt. of Documents, U.S. Government Printing Office, Washington, DC 20402-9325

HVI

Home Ventilating Institute*
1740 Dell Range Blvd., Suite H
PMB 450
Cheyenne, WY 82009

[W] HVI Publication 911: Certified Home Ventilating Product Directory
403.4.7.3.4

[W] HVI 915-2020: Procedure for Loudness Testing of Residential Fan Products
403.4.6.1, 403.4.6.2, 403.4.7.2

[W] HVI 916-2020: Air Flow Test Procedure
403.4.6.1, 403.4.6.2, 403.4.7.2

[W] HVI 920-2020: Product Performance Certification Procedure Including Verification and Challenge
403.4.6.1, 403.4.6.2, 403.4.7.2

NAIMA

North American Insulation Manufacturers Association
11 Canal Center Plaza, Suite 103
Alexandria, VA 22314

AH116—09: Fibrous Glass Duct Construction Standards
603.5, 603.9

NBBI

National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229-1183

NBIC—2017: National Board Inspection Code, Part 3
1003.3

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

2—20: Hydrogen Technologies Code
502.16.1

30A—21: Code for Motor Fuel-dispensing Facilities and Repair Garages
304.6

31—20: Standard for the Installation of Oil-burning Equipment
701.1, 801.2.1, 801.18.1, 801.18.2, 920.2, 922.1, 1308.1

37—18: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
915.1, 915.2

58—20: Liquefied Petroleum Gas Code
502.9.10

69—19: Standard on Explosion Prevention Systems
510.8.3

70—20: National Electrical Code
301.7, 306.3.1, 306.4.1, 511.1.1, 513.11, 513.12.2, 602.2.1.1, 927.2, 1104.2.2, 1106.3, 1402.8.1.4

72—19: National Fire Alarm and Signaling Code
606.3

80—19: Standard for Fire Doors and Other Opening Protectives
607.4.1.2

82—19: Incinerators and Waste and Linen Handling Systems and Equipment
601.1

85—19: Boiler and Combustion Systems Hazards Code
1004.1

91—20: Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids
502.9.5.1, 502.17

92—18: Standard for Smoke Control Systems
513.7, 513.8

96—21: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
507.1

99—21: Health Care Facilities Code
407.1

105—19: Standard for Smoke Door Assemblies and Other Opening Protectives
607.4.1.2

[W]110-22: Standard for Emergency and Standby Power Systems
915.3, 915.3.1, 915.3.2

[W]111-22: Standard on Stored Electrical Energy Emergency and Standby Power Systems
915.3, 915.4

UL—continued

641—2010: Type L Low-temperature Venting Systems—with revisions through April 2018
802.1

705—2017: Power Ventilators—with revisions through October 2018
504.5

710—2012: Exhaust Hoods for Commercial Cooking Equipment—with revisions through June 2018
507.1

710B—2011: Recirculating Systems—with revisions through August 2014
507.1, 507.2

723—2018: Surface Burning Characteristics of Building Materials
510.8, 602.2, 602.2.1, 602.2.1.6, 602.2.1.7, 604.3, 1204.1

726—95: Oil-fired Boiler Assemblies—with revisions through October 2013
916.1, 1004.1

727—2018: Oil-fired Central Furnace
918.1

729—2003: Oil-fired Floor Furnaces—with revisions through November 2016
910.1

730—2003: Oil-fired Wall Furnaces—with revisions through November 2016
909.1

731—2018: Oil-fired Unit Heaters
920.1

732—2018: Oil-fired Storage Tank Water Heaters
1002.1

737—2011: Fireplace Stoves
905.1

762—2013: Outline of Investigation for Power Ventilators for Restaurant Exhaust Appliances
506.5.1

791—2006: Residential Incinerators—with revisions through November 2014
907.1

834—04: Heating, Water Supply and Power Boilers Electric—with revisions through September 2018
1004.1

842—2015: Valves for Flammable Fluids—with revisions through May 2015
1307.1

858—2014: Household Electric Ranges—with revisions through June 2018
917.1

[W] 864—2014: Control Units and Accessories for Fire Alarm Systems—with revisions through October 2018
513.12, 606.2.2

867—2011: Electrostatic Air Cleaners—with revisions through August 2018
605.2

875—2009: Electric Dry Bath Heater—with revisions through September 2017
914.2

896—1993: Oil-burning Stoves—with revisions through November 2016
917.1, 922.1

900—2015: Air Filter Units
605.2

907—2016: Fireplace Accessories
902.2

923—2013: Microwave Cooking Appliances—with revisions through July 2017
917.1

959—2010: Medium Heat Appliance Factory-built Chimneys—with revisions through June 2014
805.6

971A—2006: Outline of Investigation for Metallic Underground Fuel Pipe
1302.9

UL—continued

2221—2010: Tests of Fire Resistive Grease Duct Enclosure Assemblies
506.3.11.3

2518—2016: Air Dispersion Systems
603.17

2523—2009: Solid Fuel-fired Hydronic Heating Appliances, Water Heaters, and Boilers—with revisions through March 2018
1002.1, 1004.1

2846—2014: Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics—with revisions through December 2016
602.2.1.7

8782—17: Outline of Investigation for Pollution Control Units for Commercial Cooking
506.5.2

[W] UL/CSA/ANCE 60335-2-40—((~~17~~)) 2019: Household and Similar Electrical Appliances—Safety—Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers
908.1, 916.1, 918.1, 918.2, Table 1101.2

UL/CSA 60335-2-89—17: Household and Similar Electrical Appliances—Safety—Part 2-89: Particular Requirements for Commercial Refrigerating Appliances with an Incorporated or Remote Refrigerant Unit or Compressor
Table 1101.2

Introduction to this document

Seattle Municipal Code Section 22.502.016 adopts Chapter 51-56 of the Washington Administrative Code (WAC) as the base language for the Seattle Plumbing Code. Chapter 51-56 WAC adopts the Uniform Plumbing Code (UPC) and adds state-level amendments. This document contains Seattle-specific amendments to Chapter 51-56 WAC.

Seattle adopts a new Chapter 1 in place of WAC 51-56-0100; it is presented in this document as an entirely new chapter. Other UPC sections are presented with Seattle's amendments incorporated, sometimes in addition to state-level amendments, using the UPC's existing format for markup.

Section numbers in Chapter 51-56 WAC correspond to the UPC chapter they contain/amend: WAC 51-56-0200 addresses Chapter 2 UPC, WAC 51-56-0300 addresses Chapter 3 UPC, and so on up to Chapter 51-56-1700 addressing Chapter 17 UPC. The amendments in this document to each UPC chapter are amendments to the corresponding WAC section.

CHAPTER 1
ADMINISTRATION

Chapter 1 is entirely Seattle amendments; changes from the 2021 Uniform Plumbing Code with Washington State amendments are not shown.

SECTION 101
TITLE, SCOPE, AND PURPOSE

101.1 Title. These regulations shall be known as the "Seattle Plumbing Code," may be cited as such, and are referred to herein as "this Code." All references to the Uniform Plumbing Code contained in this Code mean the Seattle Plumbing Code.

101.2 Scope. This Code applies to the erection, installation, alteration, repair, relocation, replacement, addition to, use or maintenance of plumbing systems within the City. The design and testing of equipment regulated by this Code are subject to the approval of the Authority Having Jurisdiction.

101.3 Purpose. The purpose of this Code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation, and maintenance or use of plumbing systems within the City.

The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

101.4 Applicability of City Laws. A plumbing permit application shall be considered under applicable city law in effect on the date a valid and fully complete plumbing permit application is submitted or on a date as otherwise required by law.

101.4.1 Complete Plumbing Permit Applications. A plumbing permit application is complete if the Authority Having Jurisdiction determines it meets the requirements of Sections 107.1 and 107.6 through 107.7.7.

Exception: When the Authority Having Jurisdiction allows a plumbing permit application to be submitted in phases for portions of the building, each phased portion submittal shall meet the requirements of Sections 107.1 and 107.6 through 107.7.7 applicable to the scope of the allowed phased portion, and the plumbing permit application shall be considered complete for the purpose of Section 101.4 on the date the phased portion submittal is submitted.

101.4.2 Permit Conditions and Denial. The Authority Having Jurisdiction may impose on a permit any conditions authorized by this Code or other pertinent ordinances, regulations or laws. In addition, the Authority Having Jurisdiction may deny a permit if the Authority Having Jurisdiction determines that the proposed project or plumbing design documents do not conform to the requirements of this Code, or other pertinent laws, ordinances or regulations.

101.5 Internal Consistency. If in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. If there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

101.6 Referenced Codes and Standards. The codes and standards referenced in this code are part of the requirements of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the equipment or appliance, the conditions of the listing and manufacturer's instructions apply.

101.7 Appendices. Provisions in the Uniform Plumbing Code appendices do not apply except Appendices A, B, I and M which are specifically adopted.

101.8 Metric Units. Wherever in this Code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

101.9 References to Other Codes. Whenever an International, National or Uniform Code is referenced in this Code, it means the Seattle edition of that Code, including local amendments. References to the "Building Code," "Mechanical Code," "Fuel Gas Code," "Fire Code" and "Residential Code" mean the Seattle editions of those codes.

SECTION 102
ORGANIZATION AND DUTIES OF AUTHORITY HAVING JURISDICTION

102.1 Jurisdiction of Public Health—Seattle and King County. The Director of Public Health—Seattle and King County is the Authority Having Jurisdiction. The Director and the Director's authorized representative are authorized to

administer and enforce this code; provided, that the Director of Seattle Public Utilities or his or her authorized representative shall administer and enforce provisions relating to the inspection and approval of water meters and, where applicable, building supply piping.

102.2 Designees. The Authority Having Jurisdiction may appoint such officers, inspectors, assistants and employees as are authorized from time to time. The Authority Having Jurisdiction may authorize such employees and other agents as may be necessary to carry out the functions of the Authority Having Jurisdiction.

102.3 Right of Entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the Authority Having Jurisdiction may enter a building or premises at any reasonable time to perform the duties imposed by this code.

102.4 Modifications. The Authority Having Jurisdiction may modify the provisions of this Code for individual cases if the Authority Having Jurisdiction finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety and sanitation when considered together with other safety features of the building or other relevant circumstances. The Authority Having Jurisdiction may, but is not required to, record the approval of modifications and any relevant information in the files of the Authority Having Jurisdiction or on the approved construction documents.

102.5 Liability. Nothing in this Code is intended to be nor shall be construed to create or form the basis for any liability on the part of the Authority Having Jurisdiction or the City, or their officers, employees or agents, for any injury or damage resulting from the failure of equipment to conform to the provisions of this Code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or approval authorized or issued or done in connection with the implementation or enforcement of this Code, or by reason of any action or inaction on the part of the Authority Having Jurisdiction or the City related in any manner to the enforcement of this code by their officers, employees or agents.

This Code shall not be construed to lessen or relieve the responsibility of any person owning, operating or controlling any equipment, building or structure for any damages to persons or property caused by defects, nor shall the Authority Having Jurisdiction or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this Code or any permits or certificates issued under this Code.

102.6 Responsibilities of Parties.

102.6.1 Responsibility for Compliance. Compliance with the requirements of this code is the obligation of the owner of the building, structure or premises, the authorized agent of the owner, and other persons responsible for the condition or work, and not of the Authority Having Jurisdiction or the City or any of their officers, employees or agents.

102.6.2 Responsibilities of Registered Design Professional in Responsible Charge. It is the responsibility of the registered design professional in responsible charge to ensure that the information in the plumbing system documents is complete, accurate, and, to the best of the design professional's knowledge, complies with the requirements of this Code.

102.6.3 Responsibilities of Contractor. It is the responsibility of the contractor to perform all the work in compliance with this Code, and in accordance with the approved plumbing design documents.

102.6.4 Responsibilities of Plans Examiner. It is the responsibility of the plans examiner to verify that the description of the work in the plumbing design documents is substantially complete, and to require corrections where, to the best of the plans examiner's knowledge, the plumbing design documents do not conform to this Code or other pertinent laws and ordinances.

102.6.5 Responsibilities of Field Inspector. It is the responsibility of the field inspector to conduct inspections to verify that the work in progress conforms with the approved plumbing design documents and to require corrections where, to the best of the field inspector's knowledge, the work either does not conform to the plumbing design documents or where the work is in violation of this Code or other pertinent laws and ordinances.

SECTION 103
RULES OF THE AUTHORITY HAVING JURISDICTION

103.1 Authority. The Authority Having Jurisdiction has authority to issue interpretations of this Code and to adopt and enforce rules and regulations supplemental to this Code as may be deemed necessary to clarify the application of the provisions of this Code. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this Code.

103.2 Procedure for Adoption of Rules. The Authority Having Jurisdiction shall promulgate, adopt and issue rules according to the procedures specified in the Administrative Code, Chapter 3.02 of the Seattle Municipal Code.

103.3 Construction Codes Advisory Board Committee. A committee of the Construction Codes Advisory Board may examine proposed administrative rules, and amendments relating to this Code and related provisions of other codes and make

recommendations to the Authority Having Jurisdiction and to the City Council for changes in this code. The committee will be called on as needed by the Construction Codes Advisory Board.

SECTION 104
APPLICATION TO EXISTING PLUMBING SYSTEMS

104.1 Additions, Alterations, Renovations or Repairs. Additions, alterations, renovations or repairs may be made to any plumbing system without requiring the existing plumbing system to comply with all the requirements of this Code, if the addition, alteration, renovation or repair conforms to the standards required for a new plumbing system. Additions, alterations, renovations or repairs shall not cause an existing system to become unsafe, unhealthy or overloaded.

Minor additions, alterations, renovations, and repairs to existing plumbing systems may be installed in accordance with the law in effect at the time the original installation was made, if approved by the Authority Having Jurisdiction.

104.2 Existing Installations. Plumbing systems lawful at the time of the adoption of this Code may continue their use, be maintained or repaired, or have components replaced if the use, maintenance, repair, or component replacement is done in accordance with the basic original design and location, and no hazard to life, health or property has been or is created by such plumbing system.

104.3 Changes in Building Occupancy. Plumbing systems that are a part of a building or structure undergoing a change in occupancy as defined in the International Building Code shall comply with all requirements of this Code that are applicable to the new use or occupancy.

104.4 Maintenance. All plumbing systems, materials, equipment, appurtenances and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices or safeguards that were required by a code in effect when the plumbing system was installed shall be maintained in conformance with the code edition under which installed.

The owner or the owner's designated agent is responsible for maintenance of plumbing systems and equipment. To determine compliance with this subsection, the Authority Having Jurisdiction may cause a plumbing system or equipment to be reinspected.

104.5 Health and Safety. Where compliance with the provisions of this Code fails to eliminate or alleviate a nuisance, or other dangerous or insanitary condition that involves health or safety hazards, the owner or the owner's agent shall install such additional plumbing and drainage facilities or shall make such repairs or alterations as ordered by the Authority Having Jurisdiction.

104.6 Landmarks—Historic Buildings and Structures. The Authority Having Jurisdiction may modify the specific requirements of this Code as it applies to landmarks and require in lieu thereof alternate requirements that, in the opinion of the Authority Having Jurisdiction, will result in a reasonable degree of safety to the public and the occupants of those buildings.

For purposes of this section, a landmark is a building or structure: that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics, that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation, that has been designated for preservation by the City Landmarks Preservation Board, that has been designated for preservation by the State of Washington, that has been listed or determined eligible to be listed in the National Register of Historic Places, or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

SECTION 105
UNSAFE PLUMBING SYSTEM, EQUIPMENT AND HAZARD CORRECTION ORDER

105.1 Emergency Order. Whenever the Authority Having Jurisdiction finds that any plumbing system or equipment regulated by this Code is in such a dangerous and unsafe condition as to constitute an insanitary condition, which may cause an imminent hazard to life or limb, the Authority Having Jurisdiction may issue an emergency order. The emergency order may (1) direct that the plumbing system and equipment be restored to a safe and sanitary condition by a date certain; (2) require that the building, structure or premises, or portion thereof, containing the insanitary plumbing and equipment be vacated within a reasonable time to be specified in the order, or in the case of extreme danger and unsafe condition, the order may specify immediate vacation of the building, structure or premises, or portion thereof; or (3) authorize immediate disconnection of the utilities.

105.1.1 Service of Emergency Order. The order shall be posted on the premises or personally served on the owner of the building or premises or any person responsible for the condition. The order shall specify the time for compliance.

105.1.2 Effect of Emergency Order. No person may occupy a building, structure or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure or premises, or portion thereof, is

restored to a safe and sanitary condition as required by the order and this Code. It is a violation for any person to fail to comply with an emergency order issued by the Authority Having Jurisdiction.

105.2 Hazard Correction Order. Whenever the Authority Having Jurisdiction finds that an unsafe plumbing system or equipment exists, the Authority Having Jurisdiction may issue a hazard correction order specifying the conditions causing the unsafe plumbing or equipment to be unsafe and directing the owner or other person responsible for the unsafe plumbing or equipment to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the Authority Having Jurisdiction analyzing said conditions and establishing that the equipment is, in fact, safe. The Authority Having Jurisdiction may require that the report or analysis be prepared by a licensed engineer.

105.2.1 Service of Hazard Correction Order. The order shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first class mail.

105.2.2 Effect of Hazard Correction Order. It is a violation for any person to fail to comply with a hazard correction order as specified in this subsection.

SECTION 106
ENFORCEMENT, VIOLATIONS AND PENALTIES

106.1 Violations. It is a violation of this code for any person to:

(1) Install, erect, construct, enlarge, alter, repair, replace, remodel, move, improve, remove, convert or demolish, equip, occupy, use or maintain any plumbing system or equipment, or cause or permit the same to be done, in the City, contrary to or in violation of any of the provisions of this Code.

(2) Knowingly aid, abet, counsel, encourage, hire, induce or otherwise procure another to violate or fail to comply with this Code.

(3) Use any material or install any device, appliance or equipment that is subject to this code and has not been approved by the Authority Having Jurisdiction.

(4) Violate or fail to comply with any order issued by the Authority Having Jurisdiction pursuant to the provisions of this code or with any requirements of this Code.

(5) Remove, mutilate, destroy or conceal any notice or order issued or posted by the Authority Having Jurisdiction pursuant to the provisions of this Code, or any notice or order issued or posted by the Authority Having Jurisdiction in response to a natural disaster or other emergency.

(6) Conduct work under a permit without requesting an inspection as required by Section 109.

106.2 Notice of Violation. When, after investigation, the Authority Having Jurisdiction determines that standards or requirements of this Code have been violated or that orders or requirements have not been complied with, the Authority Having Jurisdiction may issue a notice of violation upon the owner, agent, or other person responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance.

106.2.1 Service of Notice of Violation. The notice shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail. Nothing in this section limits or precludes any action or proceeding to enforce this code, and nothing obligates or requires the Authority Having Jurisdiction to issue a notice of violation prior to the imposition of civil or criminal penalties.

106.2.2 Review of Notice of Violation by the Authority Having Jurisdiction. Any person affected by a notice of violation issued pursuant to Section 106.2 may obtain a review of the notice by making a request in writing to the Authority Having Jurisdiction within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or city holiday, the period runs until 5 p.m. of the next business day.

106.2.2.1 Review Procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the Authority Having Jurisdiction unless otherwise agreed to by the person requesting the review. Any person affected by the notice of violation may submit additional information to the Authority Having Jurisdiction.

The review shall be made by a representative of the Authority Having Jurisdiction who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and a site visit.

106.2.2.2 Decision. After the review, the Authority Having Jurisdiction shall:

(1) Sustain the notice;

(2) Withdraw the notice;

(3) Amend the notice; or

(4) Continue the review to a date certain.

106.2.2.3 Order. The Authority Having Jurisdiction shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the persons requesting the review and the persons named on the notice of violation, addressed to their last known address.

106.3 Stop Work Orders. The Authority Having Jurisdiction may issue a stop work order whenever any work is being done contrary to the provisions of this Code, contrary to a permit issued by the Authority Having Jurisdiction, or in the event of dangerous or unsafe conditions related to equipment or construction. The stop work order shall identify the violation and may prohibit work or other activity on the site.

106.3.1 Service of Stop Work Order. The Authority Having Jurisdiction shall serve the stop work order by posting it in a conspicuous place at the site. If posting is not physically possible, then the stop work order may be served by personal service or by regular first class mail to the last known address of: the property owner, the person doing or causing the work to be done, or the holder of a permit if work is being stopped on a permit. For purposes of this section, service is complete at the time of posting or of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or city holiday, the period runs until 5 p.m. on the next business day.

106.3.2 Effective Date of Stop Work Order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the persons identified in Section 106.3.1 is served.

106.3.3 Review of Stop Work Orders by the Authority Having Jurisdiction. Any person aggrieved by a stop work order may obtain a review of the order by delivering to the Authority Having Jurisdiction a request in writing within two business days of the date of service of the stop work order.

106.3.3.1 Review Procedure. The review shall occur within two business days after receipt by the Authority Having Jurisdiction of the request for review unless otherwise agreed by the person making the request. Any person affected by the stop work order may submit additional information to the Authority Having Jurisdiction for consideration as part of the review at any time prior to the review. The review will be made by a representative of the Authority Having Jurisdiction who will review all additional information received and may also request a site visit.

106.3.3.2 Decision. After the review, the Authority Having Jurisdiction may:

(1) Sustain the stop work order;

(2) Withdraw the stop work order;

(3) Modify the stop work order; or

(4) Continue the review to a date certain.

106.3.3.3 Order. The Authority Having Jurisdiction shall issue an order containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first class mail to the person or persons requesting the review, any person on whom the stop work order was served, and any other person who requested a copy before issuance of the order, addressed to their last known address.

106.4 Authority to Disconnect Utilities in Emergencies. The Authority Having Jurisdiction has the authority to disconnect water, fuel-gas utility service or energy supplies to a building, structure, premises or equipment regulated by this Code in case of emergency where necessary to eliminate an immediate hazard to life or property. The Authority Having Jurisdiction may enter any building or premises to disconnect utility service. The Authority Having Jurisdiction shall, whenever possible, notify the serving utility, the owner and the occupant of the building, structure or premises of the decision to disconnect prior to taking such action, and shall notify the serving utility, owner and occupant of the building, structure or premises in writing of such disconnection immediately thereafter.

106.5 Authority to Condemn Equipment. Whenever the Authority Having Jurisdiction determines that any equipment or portion thereof regulated by this Code is hazardous to life, health or property, the Authority Having Jurisdiction shall order in writing that such equipment either be disconnected, removed or restored to a safe or sanitary condition, as appropriate. The written notice shall fix a date certain for compliance with such order. It is a violation for any person to use or maintain defective equipment after receiving such notice.

When any equipment or installation is to be disconnected, the Authority Having Jurisdiction shall give written notice of such disconnection and causes therefore within 24 hours to the serving utility, the owner and the occupant of the building, structure or premises. When any equipment is maintained in violation of this Code, and in violation of a notice issued pursuant to the provisions of this section, the Authority Having Jurisdiction shall institute any appropriate action to prevent, restrain, correct or abate the violation.

106.6 Connection After Order to Disconnect. No person shall make connections from any water, energy, fuel or power supply nor supply water, energy or fuel to any equipment regulated by this Code that has been disconnected or ordered to be

disconnected by the Authority Having Jurisdiction, or the use of which has been ordered to be discontinued by the Authority Having Jurisdiction until the Authority Having Jurisdiction authorizes the reconnection and use of such equipment.

106.7 Civil Penalties. Any person violating or failing to comply with the provisions of this Code is subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until the date compliance is achieved. In cases where the Authority Having Jurisdiction has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

106.8 Enforcement in Municipal Court. Civil actions to enforce this Code shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of a notice of violation or of an order following a review by the Authority Having Jurisdiction is not itself evidence that a violation exists.

106.9 Judicial Review. Because civil actions to enforce this Code must be brought exclusively in Seattle Municipal Court pursuant to Section 106.8, orders of the Authority Having Jurisdiction, including notices of violation issued under this chapter, are not subject to judicial review pursuant to chapter 36.70C RCW.

106.10 Alternative Criminal Penalty. Anyone who violates or fails to comply with any notice of violation or order issued by the Authority Having Jurisdiction pursuant to this Code or who removes, mutilates, destroys or conceals a notice issued or posted by the Authority Having Jurisdiction shall, upon conviction thereof, be punished by a fine of not more than $5000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

106.11 Additional Relief. The Authority Having Jurisdiction may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

106.12 Administrative Review by the Authority Having Jurisdiction. Prior to issuance of the plumbing permit, applicants may request administrative review by the Authority Having Jurisdiction of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the Authority Having Jurisdiction.

106.13 Administrative Review by the Construction Codes Advisory Board. After administrative review by the Authority Having Jurisdiction, and prior to issuance of the plumbing permit, applicants may request review of decisions or actions pertaining to the application and interpretation of this Code by the Construction Codes Advisory Board according to Seattle Building Code Section 105.11, except for stop work orders, notices of violations and revocations of permits. The review will be performed by three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the Authority Having Jurisdiction.

SECTION 107
PERMITS

107.1 Permits Required. Except as otherwise specifically provided in this Code, a permit shall be obtained from the Authority Having Jurisdiction prior to each installation, alteration, repair, replacement or remodel of any equipment or plumbing system regulated by this Code. A separate plumbing permit is required for each separate building or structure.

107.2 Work Exempt from Permit. A plumbing permit is not required for the work listed below.

(1) The stopping of leaks in drains, soil, waste, or vent pipes, provided, that when a drainpipe, soil, waste, or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, the same shall be considered as new work and a permit shall be procured and inspection made as provided in this Code.

(2) The clearing of stoppages, including the removal and reinstallation of water closets, or the repairing of leaks in pipes, valves, or fixtures, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes, or fixtures.

107.3 Compliance Required. All work shall comply with this Code, even where no permit is required.

107.4 Flood Hazard Areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard as defined in Chapter 25.06 of the Seattle Municipal Code, subject to additional standards and requirements set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance.

107.5 Emergency Repairs. In the case of an emergency, the installation, alteration or repair of any plumbing system or equipment may be made without a permit, provided that application for a permit is made within the later of 24 hours or one working day from the time when the emergency work was started.

107.6 Application for Permit. To obtain a permit, the applicant shall first file an application in a format determined by the Authority Having Jurisdiction. Every such application shall:

(1) Identify and describe the work to be covered by the permit for which application is made.

(2) Describe the land on which the proposed work is to be done by parcel number, property address or similar description that will readily identify and clearly locate the proposed building or project.

(3) Provide unit, space suite, floor level, or other information that will clearly identify the location of the project

(4) Provide the owner's name, address, and phone number of the property.

(5) Provide the contractor's business name, address, and phone number of the property.

(6) Be accompanied by plans, diagrams, computations and specifications, equipment schedules and other data as required by the Authority Having Jurisdiction.

(7) Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority.

(8) Give such other data and information as may be required by the Authority Having Jurisdiction.

(9) State the name of the owner and the name, address and phone number of a contact person.

107.6.1 Plumbing Design Documents. Plumbing design documents shall be submitted with each application for a permit, in electronic format to the Authority Having Jurisdiction. Diagrams, schedules, and other data sufficient to show the adequacy of the plans shall be submitted when required by the Authority Having Jurisdiction.

Exception: The Authority Having Jurisdiction may waive the submission of plumbing design documents where the Authority Having Jurisdiction finds that the nature of the work applied for is such that reviewing plumbing documents is not necessary to obtain compliance with this Code.

107.6.2 Preparation by Registered Design Professionals. Plumbing design documents for all plumbing work shall be prepared and designed by or under the direct supervision of a mechanical engineer licensed to practice under the laws of the State of Washington. Each sheet of plumbing documents shall bear the seal and the signature of the registered design professional before the permit is issued.

Exceptions:

(1) Detached one- and two-family dwellings, and townhomes.

(2) Design documents that do not include systems specifically required to be designed by a registered design professional shall be permitted to be submitted without a PE stamp by any individual holding an active Certified in Plumbing Design (CPD) designation issued by the American Society of Plumbing Engineers (ASPE) or by a Washington State Certified Journeyman Plumber (PL01).

(3) Design documents provided for reference only.

(4) Other work as specified by the Authority Having Jurisdiction.

107.6.3 Registered Design Professional in Responsible Charge. The Authority Having Jurisdiction is authorized to require the owner to engage and designate on the plumbing permit application a Registered Design Professional who shall act as the Registered Design Professional in Responsible Charge. If the circumstances require, the owner shall designate a substitute Registered Design Professional in Responsible Charge who shall perform the duties required of the original Registered Design Professional in Responsible Charge. The Authority Having Jurisdiction shall be notified in writing by the owner if the Registered Design Professional in Responsible Charge is changed or is unable to continue to perform their duties. The Registered Design Professional in Responsible Charge is responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design and scope of the project.

107.7 Information Required on Plumbing Design Documents. The documents shall include the following, as applicable:

107.7.1 Cover Sheet. The cover sheet shall include the project address, parcel number, scope of work narrative, legends, abbreviations, general notes, applicable code cycles, and other information as required by the Authority Having Jurisdiction.

107.7.2 Calculations and Notes. Calculations and/or load summaries shall be provided to determine system loading for each plumbing system included in the project scope of work. Provide a separate calculation for each separate utility point of connection. Domestic water pressure loss calculations shall be provided for each independent domestic water system or pressure zone. Notes shall include proposed material types and joining methods, insulation requirements, disinfection procedures, and similar information as required by the Authority Having Jurisdiction.

107.7.3 Schedules. Schedules shall be provided for all fixtures and equipment associated with the plumbing system design. Schedules shall include all information required to verify compliance with this code and the Seattle Energy Code. Such information may include operating weight, equipment make/model, applicable standards, connection sizes, flow rates, input/output ratings and similar information as required by the Authority Having Jurisdiction.

107.7.3.1 Energy Code Compliance. Equipment required to comply with provisions of the Seattle Energy Code shall include make/model and any other design or listing information required to determine compliance.

107.7.4 Plan Sheets. Plan sheets shall include building information, plumbing system design information, scale, key plan, north arrow, and similar information as required by the Authority Having Jurisdiction.

107.7.4.1 Building Information. Building information shown on plan sheets shall be screened (semi-opaque) and include information such as room names, walls, corridors, fixtures, footings, floor elevations, and other building elements relevant to the installation of the plumbing system(s).

107.7.4.2 Plumbing System Design Information. Plumbing system design information shown on plan sheets shall be easily identifiable and include all horizontal piping, all vertical risers, sizing, loading, notes, fixture and equipment tags, and similar information as required by the Authority Having Jurisdiction.

107.7.5 Riser Diagrams. Riser diagrams shall be provided for each distinct plumbing system type including sanitary waste and vent, domestic water, stormwater and roof drainage, natural gas, non-potable water, graywater, and any other system type referenced within the plumbing design documents. Riser diagrams shall include all piping from the utility or tenant point of connection to the furthest fixture or roof termination. Piping shown on riser diagrams shall be clearly sized and labeled and include loading at each pipe segment.

107.7.6 Construction Details. Construction details shall be provided for the installation of certain fixtures or equipment where determination of Code compliance may not be readily achievable through review of Plans, Schedules, Notes, or Riser Diagrams. Construction details may be required for the installation of water heaters, interceptors, pumps, backflow devices, and similar items. The Authority Having Jurisdiction may request additional construction details as deemed necessary.

107.7.7 Deferred Submittals. Deferral of any submittal items shall have the prior approval of the Authority Having Jurisdiction. The Registered Design Professional in Responsible Charge shall list deferred submittals on the plans for review by the Authority Having Jurisdiction. Documents for deferred submittal items shall be submitted to the Registered Design Professional in Responsible Charge who shall review them and forward them to the Authority Having Jurisdiction with a notation indicating that the deferred submittal documents have been reviewed and been found to be in general conformance to the plumbing design. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the Authority Having Jurisdiction.

107.7.8 Application Review. The plumbing design documents shall be reviewed by the Authority Having Jurisdiction. Such plumbing design documents may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

107.7.9 Determination of Completeness. Within 28 days after an application is filed, the Authority Having Jurisdiction shall notify the applicant in writing either that the application is complete or that it is not complete, and if not complete, what additional information is required to make it complete. Within 14 days after receiving the additional information, the Authority Having Jurisdiction shall notify the applicant in writing whether the application is now complete or what additional information is necessary. An application shall be deemed to be complete if the Authority Having Jurisdiction does not notify the applicant in writing by the deadlines in this section that the application is incomplete.

107.7.10 Decision on Application. Except as provided in Section 108.4 the Authority Having Jurisdiction shall approve, condition, or deny the application within 120 days after the Authority Having Jurisdiction notifies the applicant that the application is complete.

To determine the number of days that have elapsed after the notification that the application is complete, the following periods shall be excluded:

(1) All periods of time during which the applicant has been requested by the Authority Having Jurisdiction to correct plans, perform required studies, or provide additional required information, until the determination that the request has been satisfied. The period shall be calculated from the date the Authority Having Jurisdiction notifies the applicant of the need for additional information until the earlier of the date the Authority Having Jurisdiction determines whether the additional information satisfies the request for information or 14 days after the date the information has been provided to the Authority Having Jurisdiction.

(2) If the Authority Having Jurisdiction determines that the information submitted by the applicant under item 1 of this subsection is insufficient, the Authority Having Jurisdiction shall notify the applicant of the deficiencies, and the procedures under item 1 of this subsection shall apply as if a new request for information has been made;

(3) All extensions of time mutually agreed upon by the applicant and the Authority Having Jurisdiction.

If a plumbing permit application is substantially revised by the applicant, the time period shall start from the date at which the revised plumbing permit application is determined to be complete under Section 107.7.9.

SECTION 108
PERMIT ISSUANCE

108.1 Issuance. The application shall be reviewed by the Authority Having Jurisdiction. The application may be reviewed by other departments of the Authority Having Jurisdiction or the City to check compliance with the laws and ordinances under their jurisdiction.

108.1.1 Issuance of Permit. The Authority Having Jurisdiction shall issue a permit to the applicant if the Authority Having Jurisdiction finds the following:

(1) The work described in the construction documents substantially conforms to the requirements of this Code and other pertinent laws and ordinances;

(2) Construction documents for projects requiring Plan Review have been reviewed and Approved;

(3) The fees specified in the Seattle Municipal Code Chapter 22.504 have been paid; and

(4) The applicant has complied with all requirements to be performed prior to issuance of a permit for the work under other pertinent laws, ordinances, or regulations, or otherwise imposed by the Authority Having Jurisdiction. When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

108.2 Phased Permits. The Authority Having Jurisdiction may authorize installation of a portion or portions of a plumbing system before complete plumbing design documents for the whole plumbing project have been submitted or approved. The applicant shall proceed at the applicant's risk without assurance that a permit for the entire plumbing project will be granted.

108.3 Compliance with Approved Plans and Permit. When the Authority Having Jurisdiction issues a permit, the Authority Having Jurisdiction shall endorse the permit in writing or in electronic format and, where plans are required, stamp the plans "APPROVED." Such approved plans and permit shall not be changed, modified or altered without authorization from the Authority Having Jurisdiction, and all work shall be done in accordance with the approved plans and permit except as authorized by the Authority Having Jurisdiction during a field inspection to correct errors or omissions.

108.4 Revisions to the Permit. When changes to the approved work (plumbing design documents) are made during installation, approval of the Authority Having Jurisdiction shall be obtained prior to execution. The Authority Having Jurisdiction may approve minor changes to the plumbing design documents for work without revisions to the approved plumbing design documents when it is determined that the changes conform to the requirements of this Code and other pertinent laws, ordinances and other issued permits.

108.5 Validity of Permit. The issuance or granting of a permit or approval of plans shall:

(1) Not be construed to be a permit for, or an approval of, any violation of any of the provisions of this Code or other pertinent laws and ordinances.

(2) Not prevent the Authority Having Jurisdiction from requiring the correction of errors in the plans, or from preventing building operations being carried on thereunder when in violation of this Code or of other pertinent laws and ordinances of the City.

(3) Not prevent the Authority Having Jurisdiction from requiring correction of conditions found to be in violation of this Code or other pertinent laws and ordinances of the City, or

(4) Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the Authority Having Jurisdiction or other administrative authority requiring the correction of any such conditions.

108.6 Permit Expiration and Renewal. Authority to do the work authorized by a permit expires 18 months from the date of the issuance. A permit may be renewed to extend the duration of the permit for an additional 18 months from the original expiration date.

108.7 Revocation of Approval. The Authority Having Jurisdiction may rescind prior approval of reviewed construction documents and deny permit issuance if any of the following conditions develop:

(1) Permit applicant has not responded to a Plan Review invoice notice or request for plan corrections from the assigned Plans Examiner within 90 days of request.

(2) Permit fees have not been paid within 90 days of notification to applicant that plans have been approved and an invoice generated.

Exception: The Authority Having Jurisdiction may grant an extension to the above noted timelines if mutually agreed upon by the Authority Having Jurisdiction and the permit applicant. Any request for an extension must be initiated by the permit applicant.

SECTION 109
INSPECTIONS

109.1 General. All construction or work for which a permit is required is subject to inspection by the Authority Having Jurisdiction. In addition, the Authority Having Jurisdiction may make or require inspections of any plumbing work to ascertain compliance with the provisions of this Code and other laws and ordinances that are enforced by the Authority Having Jurisdiction.

109.2 Inspection Requests. The owner of the property or the owner's authorized agent, or the person designated by the owner or agent to do the work authorized by a permit shall notify the Authority Having Jurisdiction that work requiring inspection as specified in this section is ready for inspection.

109.3 Access for Inspection. The permit holder and the person requesting any inspections required by this Code shall provide access to and means for proper inspection of such work, including safety equipment required by the Washington Industrial Safety and Health Agency. The work shall remain accessible and exposed for inspection purposes until approved by the Authority Having Jurisdiction. Neither the Authority Having Jurisdiction nor the City shall be liable for expense entailed in the required removal or replacement of any material to allow inspection.

109.4 Inspection Record. Work requiring a plumbing permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position that allows the Authority Having Jurisdiction to conveniently make the required entries regarding inspection of the work. This record shall be maintained in such a position by the permit holder or the permit holder's agent until final approval has been granted by the Authority Having Jurisdiction.

109.5 Approvals Required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the Authority Having Jurisdiction.

109.5.1 Effect of Approval. Approval as a result of an inspection is not approval of any violation of the provisions of this Code or of other pertinent laws and ordinances of the Authority Having Jurisdiction or the City. Inspections presuming to give authority to violate or cancel the provisions of this Code or of other pertinent laws and ordinances of the Authority Having Jurisdiction or the City are not valid.

109.6 Operation of Plumbing Equipment. The requirements of this section do not prohibit the operation of any plumbing systems installed to replace existing equipment or fixtures serving an occupied portion of the building in the event a request for inspection of such equipment or fixture has been filed with the Authority Having Jurisdiction not more than 48 hours after such replacement work is completed, and before any portion of such plumbing system is concealed by any permanent portion of the building.

109.7 Special Investigation. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the Authority Having Jurisdiction's permission to proceed, the Authority Having Jurisdiction may make a special investigation inspection before a permit is issued for the work. If a special investigation is made, a special investigation fee may be assessed in accordance with the Seattle Municipal Code.

109.8 Reinspections. The Authority Having Jurisdiction may require a reinspection if work for which inspection is called is not complete, required corrections are not made, the approved plans are not readily available to the inspector, access is not provided on the date for which inspection is requested, if deviations from the plans that require the approval of the Authority Having Jurisdiction have been made without proper approval, or as otherwise required by the Authority Having Jurisdiction.

109.8.1 Reinspection Fee. The Authority Having Jurisdiction may assess a reinspection fee as set forth in the Seattle Municipal Code Section 22.504.010 for any action for which reinspection is required. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

SECTION 110
FEES

110.1 Fees. A fee for each plumbing permit and for other activities related to the enforcement of this Code shall be paid as set forth in Seattle Municipal Code Chapter 22.504.

CHAPTER 2
DEFINITIONS

* * *

203.0 – A –

* * *

[S] Air Admittance Valve. A device that allows air to enter the plumbing drainage system in one direction, to protect fixture traps from siphonage when negative pressures develop, and prevents sewer gases from entering the interior building atmosphere during static pressure or positive pressure conditions in the plumbing waste system.

* * *

210.0 – H –

* * *

[S] High Distribution Uniformity. A higher than average measurement indicating the evenness with which water is applied to the landscape by an irrigation system.

* * *

225.0 – W –

* * *

[S] Water Heater. Any *listed* heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system excluding any *appliance* or equipment that exceeds any of the following:

(1) An operating temperature of 210°F (99°C),

(2) A maximum allowable working pressure of 160 pounds per square inch (1103 kPa),

(3) A volume of 120 gallons (454 L), or

(4) A heat input of 200,000 Btu/hr (58.6 kW).

Any *appliances* and equipment that exceed any one of these values are classified as boilers.

* * *

CHAPTER 3
GENERAL REGULATIONS

* * *

[S] 308.2 Exterior Installations. Unless required to meet other provisions of this Code, or where first approved by the Authority Having Jurisdiction, no plumbing or piping system or part thereof shall be installed exterior to a building.

Exceptions:

(1) Rainwater conductors, leaders, gutters, or downspouts.

(2) Natural gas, fuel oil, or condensate piping serving exterior equipment.

(3) Non-potable water serving irrigation systems, mechanical fill stations, or similar exterior uses.

* * *

[W] [S] 312.6 Freezing Protection. No water, soil, or waste pipe shall be installed or permitted outside of a building, in attics or crawl spaces, or in an exterior wall unless, where necessary, adequate provision is made to protect such pipe from freezing. All hot and cold water pipes installed outside the conditioned space shall be insulated to a minimum of R-3 or as required by the Seattle Energy Code, whichever is greater.

* * *

CHAPTER 4
PLUMBING FIXTURES AND FIXTURE FITTINGS

* * *

[W] [S] 418.3 Location of Floor Drains. Floor drains shall be installed in the following areas:

(1) Any restroom, toilet facility, or similar area within a building containing two (2) or more water closets or a combination of one (1) water closet and one (1) urinal, except in a dwelling unit. The floor shall slope in accordance with the requirements of 418.5. Any enclosed space containing a water closet or urinal and constructed in such a way as to prevent spillage from a fixture overflow from reaching a floor drain located outside of the enclosed space shall be provided with a dedicated floor drain within the space.

(2) Laundry rooms in commercial buildings and common laundry facilities in multi-family dwelling buildings.

* * *

[S] 418.5 Floor Slope. Floors shall be sloped to floor drains.

Exceptions:

(1) Floors of parking garages.

(2) Where existing floors are constructed such that creating a slope by recess or topping slab is not feasible, a threshold of a minimum ¼ inch, but not exceeding ½ inch in height shall be provided at each entry to the room or area to prevent spillage from entering adjacent spaces.

* * *

CHAPTER 5
WATER HEATERS

* * *

[W] [S] TABLE 501.1(2)
FIRST HOUR RATING[1, 3]

Number of Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
Number of Bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating,[2] Gallons	38	49	49	49	62	62	74	62	74	74	74

For SI units: 1 gallon = 3.785 L

Notes:

[1] The first-hour rating is found on the "Energy Guide" label.

[2] Non-storage and solar water heaters shall be sized to meet the appropriate first-hour rating as shown in the table and shall be capable of delivering hot water at the maximum system demand flow, as calculated in Section 610.0 or Appendix A, as applicable.

[3] For replacement water heaters, see Section 104.1.

* * *

[S] 501.2 Water Heaters Used for Space Heating. Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be listed and labeled for such applications by the manufacturer and shall be installed in accordance with the manufacturer's instructions and this code.

* * *

CHAPTER 6
WATER SUPPLY AND DISTRIBUTION

* * *

[S] 608.1 Inadequate Water Pressure. Where the water pressure in the main or other source of supply will not provide a residual water pressure of not less than 15 pounds force per square inch (psi) (103 kPa), after allowing for friction and other pressure losses, a tank and a pump or other means that will provide said 15 psi (103 kPa) pressure shall be installed. Where fixtures, fixture fittings, or both are installed that, require residual pressure exceeding 15 psi (103 kPa), that minimum residual pressure shall be provided. ASSE listed temperature and/or pressure compensating valves shall be provided with a minimum residual pressure equal to or greater than the minimum test pressure of the applicable standard or 20 psi (138 kPa), whichever is greater.

* * *

[W] [S] 609.12 Pipe Insulation. Domestic water piping within commercial buildings shall be insulated in accordance with the Seattle Energy Code.

* * *

[S] TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—
Lavatory[9]	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	—	1.0	1.0	—
Mobile Home, each (minimum)	—	12.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinical Faucet	½	—	3.0	—
Clinical Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, flush tank	½	2.0	2.0	3.0
Nonwater Urinal with Drain Cleansing Action	½	1.0	1.0	1.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote[7]		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote[7]		—

For SI units: 1 inch = 25 mm

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions.

6 Assembly [Public Use (See Table 422.1)].

7 Where sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

9 The minimum fixture branch size may be reduced to 3/8" when serving a single lavatory.

* * *

[W] [S] 611.1 Application. The owner of a building that serves potable water to twenty-five or more people at least sixty or more days per year and that installs drinking water treatment units including, but not limited to, the treatment units in Section 611.1, may be regulated (as a Group A public water system) by the Washington State Department of Health under Chapter 246-290 WAC. See Washington State Department of Health publication 331-488 for guidance.

611.1.1 Alkaline Water Treatment. Alkaline water treatment devices shall comply with IAPMO IGC 322.

611.1.2 Scale Reduction Devices. Scale reduction devices shall comply with IAPMO Z601.

CHAPTER 7
SANITARY DRAINAGE

* * *

[S] TABLE 702.2(2)
DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR INTERMITTENT FLOW ONLY*

GPM	FIXTURE UNITS
Up to 7½	Equals 1 Fixture Unit
Greater than 7½ to 15	Equals 2 Fixture Units
Greater than 15 to 30	Equals 4 Fixture Units
Greater than 30 to 50	Equals 6 Fixture Units
Greater than 50 to 100	Equals 12 Fixture Units
Greater than 100 to 200	Equals 18 Fixture Units
Greater than 200 to 350	Equals 24 Fixture Units

For SI units: 1 gallon per minute = 0.06 L/s

* Discharge capacity exceeding 350 gallons per minute (3.15 L/s) shall be determined by the Authority Having Jurisdiction.

* * *

[W] [S] 704.3 Commercial Sinks. Except where specifically required to be connected indirectly to the drainage system, or when first approved by the Authority Having Jurisdiction, all plumbing fixtures, drains, appurtenances, and appliances, including 3-compartment sinks, shall be directly connected to the drainage system of the building or premises.

* * *

[S] 709.1 General. Plumbing fixtures shall be drained to the sanitary waste system by gravity flow and are permitted to be pumped or ejected as allowed per Section 710.2 or when approved by the Authority Having Jurisdiction.

* * *

[S] 710.4 Discharge Line. The discharge line from such ejector, pump, or another mechanical device shall be of approved pressure rated material and be provided with an accessible backwater or swing check valve and gate or ball valve. Where the gravity drainage line to which such discharge line connects is horizontal, the method of connection shall be from the top through a wye branch fitting. The gate or ball valve shall be located on the discharge side of the backwater or check valve.

Gate or ball valves, where installed in drainage piping, shall be fullway type with working parts of corrosion-resistant metal. Sizes 4 inches (100 mm) or more in diameter shall have cast-iron bodies and sizes less than 4 inches (100 mm), cast-iron or copper alloy bodies. Discharge lines from elevator hoistway pumps shall be provided with a check valve and lockable gate or ball valve locked in the open position and located outside of the hoistway.

Exception: The discharge line of a pump serving an elevator hoistway shall be routed through an air break to an approved indirect receptor. The indirect receptor shall be provided with an outlet, tailpiece, and trap (if applicable) large enough to accommodate the design flow rate of the largest pump discharging to the indirect receptor. The trap seal of such receptor (if applicable) shall be maintained by a trap primer in accordance with section 1007.0.

[S] 710.5 Size of Building Drains and Sewers. Building drains or building sewers receiving a discharge from a pump or ejector shall be adequately sized to prevent overloading. Two fixture units shall be allowed for each gallon per minute (L/s) of flow.

Exception: Where first approved by the Authority Having Jurisdiction, the discharge from pumps or ejectors provided for periodic testing or emergency use only may be assigned fixture unit loading in accordance with Table 702.2(2). All gravity drainage piping and/or pretreatment devices downstream of such pumps shall be adequately sized for continuous full flow of the pumped discharge under emergency or test conditions.

* * *

CHAPTER 8
INDIRECT WASTES

* * *

[S] 803.3 Pipe Size and Length. Except as hereinafter provided, the size of indirect waste piping shall be in accordance with other sections of this code applicable to drainage and vent piping. No vent from indirect waste piping shall combine with a sewer-connected vent, but shall extend separately to the outside air. Indirect waste pipes exceeding 5 feet (1524 mm), but less than 15 feet (4572 mm) in length shall be directly trapped, but such traps need not be vented.

Indirect waste pipes less than 15 feet (4572 mm) in length shall be not less than the diameter of the drain outlet or tailpiece of the fixture, appliance, or equipment served, and in no case less than ½ of an inch (15 mm). Angles and changes of direction in such indirect waste pipes shall be provided with cleanouts to permit flushing and cleaning.

Exceptions:

(1) Gravity indirect waste pipes connected to elevator hoistway drains shall be provided with a normally closed backwater valve or a vented running trap installed in accordance with section 1008.1. Where a trap is provided, the trap seal shall be maintained by an automatic electronic trap primer.

(2) Unless required by the Authority Having Jurisdiction, traps and vents shall not be required in indirect waste piping from backflow or pressure relief devices or other similar applications intended for emergency use only.

* * *

CHAPTER 9
VENTS

* * *

[S] 903.1 Applicable Standards. Vent pipe and fittings shall comply with the applicable standards referenced in Table 701.2, except that:

(1) No galvanized steel or 304 stainless steel pipe shall be installed underground and shall be not less than 6 inches (152 mm) aboveground.

(2) ABS and PVC DWV piping installations shall be in accordance with the applicable standards referenced in Table 1701.1. Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 where tested in accordance with ASTM E84 or UL 723. These tests shall comply with all requirements of the standards to include the sample size, both for width and length. Plastic pipe shall not be tested filled with water.

* * *

[S] 913.0 Air Admittance Valves.

913.1 General. Vent systems utilizing air admittance valves shall comply with this section.

913.2 Where Permitted. Individual fixtures, a branch vent, a vertical wet vent, and a horizontal wet vent shall be permitted to terminate with a connection to an air admittance valve. Fixtures connected to an air admittance valve shall be located on the same floor level.

913.3 Installation. Air admittance valves shall conform to ASSE 1051 for single fixtures, and ASSE 1050 for multiple fixtures, and shall be installed as required in this section and the manufactures installations guidelines.

913.3.1 Location.

(1) Air admittance valves shall be accessible and located in an area that allows air to enter the valve.

(2) The air admittance valve shall be located a minimum of four (4) inches above the trap arm.

(3) The air admittance valve that serves as a vent termination for a branch vent, or vertical and horizontal wet vent, shall be located at a minimum of six (6) inches above the flood level rim of the highest fixture being vented.

(4) The air admittance valve shall be located within the maximum developed length permitted for the vent as shown in Table 703.2.

(5) The air admittance valve shall be installed not less than six (6) inches above insulation materials.

913.4 Size. The air admittance valve shall be rated in accordance with the standard for the vent size as determined in Table 703.2.

913.5 Vent Required. Not less than one plumbing vent sized as required by Section 904.1, shall extend to the exterior of the building as required in Section 906.1.

913.6 Relief Vent. When a horizontal branch drain utilizes an individual or branch type air admittance valve, a relief vent shall be installed when the horizontal branch drain is located more than four (4) branch intervals from the top of the building drain (waste stack), and the relief vent shall extend to the outdoors or connect to a vent stack.

The relief vent shall be sized in accordance with Section 904.1, installed in accordance with Sections 905.0, and shall be permitted to serve as the vent for other fixtures.

913.6.1 Prior Approval. Installations that require a relief vent shall be submitted for an installation design review.

913.7 Prohibited Installations.

913.7.1 Sumps. Air admittance valves shall not be utilized to vent sumps or tanks of any type.

913.7.2 Chemical Waste Systems. Air admittance valves shall not be installed in nonneutralized chemical waste systems without a design review and approval by the Authority Having Jurisdiction.

913.7.3 FOG Disposal Systems. Air admittance valves shall not be installed on any fixtures that are connected to a *FOG disposal system*.

913.7.4 Plenums. Air admittance valves shall not be located in spaces utilized as supply or return air plenums.

CHAPTER 10
TRAPS AND INTERCEPTORS

* * *

[S] 1007.3 Trap Priming Water. Trap primers serving floor drains located in rooms that contain fixtures served by a nonpotable water system complying with Chapter 15 or 16 shall also be served by the nonpotable water system.

* * *

[S] 1014.1.3 Food Waste Disposers and Dishwashers. No food waste disposer or dishwasher shall be connected to or discharge into a grease interceptor.

Exception: Food waste disposers shall be permitted to discharge to grease interceptors that are designed to receive the discharge of food waste, or a listed food solids interceptor shall be installed at the discharge of the food waste disposer.

* * *

[S] 1018.0 Parking Garage Drainage Systems. Parking garage drainage systems shall comply with Sections 1018.1 and 1018.2. All plans for parking garage floor drainage systems shall be submitted to the Authority Having Jurisdiction and approved prior to installation.

[S] 1018.1 Parking Garage Drains. Drains connected to the parking garage drainage system shall comply with the following:

(1) Unless otherwise approved by the Authority Having Jurisdiction, drains serving parking or loading dock areas exposed to precipitation and greater than 200 square feet shall be connected to the building storm drainage system. All other parking garage and/or loading dock drainage shall be connected to the sanitary drainage system through the use of a sand interceptor or oil/water separator.

(2) Parking garage drain outlets and connected drainage waste lines shall be a minimum of three inches in diameter. Waste unit loading for parking garage drains shall be sized in accordance with Table 702.2(1) or Table 702.2(2). Drainage piping serving parking garage drains shall be sized in accordance with Table 703.2.

(3) Drains of any type connected to the parking garage drainage system shall be equipped with approved strainers and need not be trapped or vented when connected to the building drain though a properly trapped and vented sand interceptor or oil/water separator. Drains at floor level and subject to vehicular traffic shall be equipped with strainers with a load rating appropriate to the use of the parking area served.

(4) Traps shall not be used when drains are located in areas exposed to freezing temperatures.

(5) The waste line from drains entering a sand interceptor or oil/water separator shall be at an elevation equal to or above the waste line discharging from the sand interceptor or oil/water separator.

(6) The sand interceptor or oil/water separator receiving the discharge from parking garage floor drains shall have a water seal of not less than six inches. Sand interceptors shall meet the requirements of Section 1016.0. Oil/water separators shall meet the requirements of Section 1009.0. Submittal information shall be provided to the Authority Having Jurisdiction prior to installation. The water seal of the sand interceptor or oil/water separator shall be maintained by an automatic electronic trap primer discharging not less than ½ gallon per day.

[S] 1018.2 Drainage From Other Plumbing Fixtures. Drainage from any plumbing fixture other than a parking garage floor drain shall not be interconnected with the parking garage drainage system.

Exception: Where first approved by the Authority Having Jurisdiction, the following types of drains may be connected to the parking garage drainage system upstream of the sand interceptor or oil/water separator and need not be individually trapped or vented, provided that all drainage piping downstream of such drains, including the sand interceptor or oil/water separator, is sized to accommodate the largest flow of effluent anticipated from any single connected drain under worst case or emergency conditions:

(1) Drains within car or truck washing areas and drainage lines from car or truck washing equipment.

(2) Approved indirect receptors located within the parking garage and accepting drainage from fire/sprinkler standpipes, fire water storage tanks, mechanical condensate, relief valves, or other similar clear water waste only.

(3) Approved indirect receptors located within the parking garage and accepting drainage from hoistway pumps or drains required by ASME A17.1, provided the discharge from the sand interceptor or oil/water separator connects to the building drain by gravity and not to a sanitary lift station.

(4) Where the sand interceptor or oil/water separator discharges to a sanitary lift station, an approved indirect receptor located within the parking garage and accepting drainage from a pump serving a hoistway containing a Fire Service Access or Occupant Evacuation Operation Elevator that is required to be on Emergency Power per Seattle Building Code Section

403.4.8.4 may only be connected to the parking garage drainage system when the floor of the hoistway enclosure is above the flood level rim of the sanitary lift station, and/or the hoistway enclosure is protected in accordance with Seattle Building Code Section 403.6.1.2. Sanitary lift station pumps shall not be connected to Emergency Power.

(5) Floor drains and indirect receptors within mechanical rooms, water entry rooms, fire pump rooms, and similar spaces where no graywater or blackwater producing fixtures are located, provided such rooms have a door or doors that open directly into the parking garage and are directly and continuously exhausted by mechanical means or provided with permanent fixed openings into the parking garage.

Note: For the purposes of this section, a mop sink, utility sink, or similar fixture shall not be considered an approved indirect receptor.

* * *

CHAPTER 11
STORM DRAINAGE

* * *

[W] [S] 1101.4 Material Uses. Pipe, tube, and fittings conveying rainwater shall be of such materials and design as to perform their intended function to the satisfaction of the Authority Having Jurisdiction. Conductors within a vent or shaft shall be of cast-iron, galvanized steel, wrought iron, copper, copper alloy, lead, Schedule 40 ABS DWV, Schedule 40 PVC DWV, stainless steel 304 or 316L [stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground], or other approved materials, and changes in direction shall conform to the requirements of Section 706.0.

ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Table 1701.1. Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, when tested in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with ASTM E84 and UL 723.

* * *

[W] [S] 1101.12.2.2.2 Combined System. The secondary roof drains shall connect to the vertical piping of the primary storm drainage conductor downstream of the last horizontal offset located below the roof. The primary storm drainage system shall connect to the building storm water that connects to an underground public storm sewer. The combined secondary and primary roof drain systems shall be sized in accordance with Section 1103.0 based on double the rainfall rate for the local area. A relief drain shall be connected to the combined vertical drainage piping, within 20 feet of grade, using a wye-type fitting piped to daylight on the exterior of the building. The piping shall be sized as required for a secondary drain with a 4 inch maximum.

* * *

[S] 1101.16.2 Combining Storm with Sanitary Drainage. The sanitary and storm drainage systems of a building shall be entirely separate from the building to the property line.

* * *

Part I—Administrative

CHAPTER 1

ADMINISTRATION

Note: Chapter 1 is entirely Seattle amendments to the *International Residential Code* and is not underlined.

SECTION R101
TITLE, SCOPE AND PURPOSE

R101.1 Title. This subtitle shall be known as the "*Seattle Residential Code*" and may be so cited, and is referred to herein as "this code."

R101.2 Scope. This code applies to the construction, *alteration*, moving, addition, replacement, demolition, repair, *equipment*, location, removal, use and occupancy of detached one- and two-family dwellings, *adult family homes*, and townhouses not more than three stories above grade plane in height with a separate means of egress and their *accessory structures* not more than three stories above grade plane in height.

Exceptions:

1. Live/work units located in townhouses and complying with the requirements of Section 508.5 of the *International Building Code* are permitted to be constructed in accordance with this code. An automatic sprinkler system required by Section 508.5.7 of the *International Building Code* shall conform to Section P2904 of this code.
2. Owner-occupied lodging houses with one or two guestrooms are permitted to be constructed in accordance with this code.
3. Owner-occupied lodging houses with three to five guestrooms are permitted to be constructed in accordance with this code when equipped with an automatic sprinkler system that complies with Section P2904 of this code.
4. A care facility with five or fewer persons receiving custodial care within a dwelling unit shall be permitted to be constructed in accordance with the International Residential Code for One- and Two-Family Dwellings where equipped with an automatic fire sprinkler system in accordance with Section P2904 of this code.
5. A care facility with five or fewer persons receiving medical care within a dwelling unit shall be permitted to be constructed in accordance with the International Residential Code for One- and Two-Family Dwellings where equipped with an automatic fire sprinkler system in accordance with Section P2904 of this code.
6. A care facility with five or fewer persons receiving care that are within a single-family dwelling shall be permitted to be constructed in accordance with the International Residential Code for One- and Two-Family Dwellings where equipped with an automatic fire sprinkler system in accordance with Section P2904 of this code.
7. Floating on-water residences as defined in Seattle Municipal Code Title 23 are not required to comply with this Code.

Note: The seismic design for wood-frame buildings with more than two stories above grade are required to comply with the *International Building Code* or other standards referenced in Section R301.1. See Sections R301.2.2.1 and Table R602.10.3(3).

Interpretation R101.2a: Buildings with mixed occupancies, other than residences with home occupations, are not within the scope of the *Seattle Residential Code* and shall comply with the *Seattle Building Code*.

Interpretation R101.2b: Three or more dwellings located above a common garage or other common space are required to comply with the *Seattle Building Code*. Units in detached one- and two-family dwellings may share common space.

R101.3 Applicability of city laws. A building permit application shall be considered under the applicable city law in effect on the date a valid and fully complete building permit application is submitted or on a date as otherwise required by law.

Exception: For any project for which an associated, unexpired master use permit has been issued, a building permit application shall be considered under the versions of Seattle Municipal Code Title 23, Seattle Land Use Code; Seattle Municipal Code Chapter 25.09, Environmentally Critical Areas regulations; and Seattle Municipal Code Chapter 25.11, Tree Protection regulations, in effect on the date established by Seattle Municipal Code Section 23.76.026 or 23.76.032.C.1 for

consideration of the master use permit, unless that date is later than the date of the complete building permit application. This exception does not apply to a subdivision or short subdivision component of a master use permit.

Note: Applicable city law includes but is not limited to Seattle Municipal Code Title 23, Seattle Land Use Code; Seattle Municipal Code Chapter 25.09, Environmentally Critical Areas regulations; Seattle Municipal Code Chapter 25.11, Tree Protection regulations; and Seattle Municipal Code Title 22, Building and Construction Codes.

R101.3.1 Complete building permit applications. A building permit application is complete if the *building official* determines it meets the requirements of Sections R105.5 through R105.6.4, and the application includes, without limitation, the *construction documents* for the architectural and structural components of the building.

Exception: If the *building official* allows a building permit application to be submitted in phases for portions of a building, each phased portion submittal shall meet the requirements of Sections R105.5 through R105.6.4 applicable to the scope of the allowed phased portion, and the building permit application shall be considered complete for the purposes of Section R101.3 on the date the phased portion submittal that includes the structural frame for the entire building is submitted.

R101.4 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, occupancy, location and maintenance of buildings and structures within the City and certain *equipment* specifically regulated herein. The purpose of this code is to provide for and promote the health, safety and welfare of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefitted by the terms of this code.

R101.5 Internal consistency. Where in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive governs. Where there is a conflict between a general requirement and a specific requirement, the specific requirement governs.

R101.6 Referenced codes and standards. The codes and standards referenced in this code are considered part of this code to the extent prescribed by each such reference. If differences occur between provisions of this code and referenced codes and standards, the provisions of this code apply, except that nothing in this code limits the effect of any provision of the Grading Code, Stormwater Code, or Regulations for Environmentally Critical Areas.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the *equipment* or *appliance*, the conditions of the listing and manufacturer's instructions apply.

R101.7 Appendices. Provisions in the appendices of the *International Residential Code* do not apply unless specifically adopted.

R101.8 Metric units. Wherever in this code there is a conflict between metric units of measurement and U.S. customary units, the U.S. customary units govern.

SECTION R102
UNSAFE BUILDINGS, STRUCTURES OR PREMISES

R102.1 Emergency order. Whenever the *building official* finds that any building or structure or premises, or portion thereof is in such a dangerous and unsafe condition as to constitute an imminent hazard to life or limb, the *building official* may issue an emergency order. The emergency order may (1) direct that the building, structure or premises, or portion thereof be restored to a safe condition by a date certain; (2) require that the building, structure or premises, or portion thereof, be vacated within a reasonable time to be specified in the order, or in the case of extreme danger, may specify immediate vacation of the building, structure or premises, or portion thereof; or (3) authorize immediate disconnection of the utilities or energy source.

R102.1.1 Service of emergency order. The order shall be posted on the premises or personally served on the owner of the building or premises or any person responsible for the condition. The order shall specify the time for compliance.

R102.1.2 Effect of emergency order. No person may occupy a building, structure or premises, or portion thereof, after the date on which the building is required to be vacated until the building, structure or premises, or portion thereof, is restored to a safe condition as required by the order and this code. It is a violation for any person to fail to comply with an emergency order issued by the *building official*.

R102.2 Hazard correction order. Whenever the *building official* finds that an unsafe building, structure or premises exists, the *building official* may issue a hazard correction order specifying the conditions causing the building, structure or premises to be unsafe and directing the owner or other person responsible for the unsafe building, structure or premises to correct the condition by a date certain. In lieu of correction, the owner may submit a report or analysis to the *building official* analyzing said conditions and establishing that the building, structure or premises is, in fact, safe. The *building official* may require that

the report or analysis be prepared by a licensed engineer and may require compliance with *International Existing Building Code*.

R102.2.1 Service of hazard correction order. The order shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the order may be posted in a conspicuous place on the premises. The order may also be posted if served by personal service or first class mail.

R102.2.2 Effect of hazard correction order. It is a violation for any person to fail to comply with a hazard correction order as specified in this subsection.

SECTION R103
ENFORCEMENT, VIOLATIONS AND PENALTIES

R103.1 Violations. It is a violation of this code for any person to:

1. Erect, construct, enlarge, repair, move, improve, remove, convert, demolish, equip, occupy, inspect or maintain any building or structure, or cause or permit the same to be done, in the City, contrary to or in violation of any of the provisions of this code;
2. Knowingly aid, abet, counsel, encourage, hire, induce or otherwise procure another to violate or fail to comply with this code;
3. Use any material or to install any device, *appliance* or *equipment* that does not comply with applicable standards of this code or that has not been *approved* by the *building official*;
4. Violate or fail to comply with any notice or order issued by the *building official* pursuant to the provisions of this code or with any requirements of this code;
5. Remove, mutilate, destroy or conceal any notice or order issued or posted by the *building official* pursuant to the provisions of this code, or any notice or order issued or posted by the *building official* in response to a natural disaster or other emergency;
6. Conduct work under a permit without requesting an inspection as required by Section R106.

R103.2 Notice of violation. If, after investigation, the *building official* determines that standards or requirements of this code have been violated or that orders or requirements have not been complied with, the *building official* may issue a notice of violation upon the owner, agent or other person responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance.

R103.2.1 Service of notice of violation. The notice shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person, or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail. Nothing in this section limits or precludes any action or proceeding to enforce this code, and nothing obligates or requires the *building official* to issue a notice of violation prior to the imposition of civil or criminal penalties.

R103.2.2 Review of notice of violation by the building official. Any person affected by a notice of violation issued pursuant to Section R103.2 may obtain a review of the notice by making a request in writing to the *building official* within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, or City holiday, the period runs until 5 p.m. of the next business day.

R103.2.2.1 Review procedure. The review shall occur not less than ten nor more than 20 days after the request is received by the *building official* unless otherwise agreed to by the person requesting the review. Any person affected by the notice of violation may submit additional information to the *building official*. The review shall be made by a representative of the *building official* who will review any additional information that is submitted and the basis for issuance of the notice of violation. The reviewer may request clarification of the information received and may conduct a site visit.

R103.2.2.2 Decision. After the review, the *building official* shall:

1. Sustain the notice;
2. Withdraw the notice;
3. Continue the review to a date certain; or
4. Amend the notice.

R103.2.2.3 Order. The *building official* shall issue an order containing the decision within 15 days of the date that the review is completed and shall cause the order to be mailed by regular first class mail to the persons requesting the review and the persons named on the notice of violation, addressed to their last known address.

R103.3 Stop work orders. The *building official* may issue a stop work order whenever any work is being done contrary to the provisions of this code, or contrary to a permit issued by the *building official*, or in the event of dangerous or unsafe conditions related to construction or demolition. The stop work order shall identify the violation and may prohibit work or other activity on the site.

R103.3.1 Service of stop work order. The *building official* shall serve the stop work order by posting it in a conspicuous place at the site. If posting is not physically possible, then the stop work order may be served by personal service or by regular first class mail to the last known address of: the property owner, the person doing or causing the work to be done, or the holder of a permit if work is being stopped on a permit. For purposes of this section, service is complete at the time of posting or of personal service, or if mailed, three days after the date of mailing. When the last day of the period so computed is a Saturday, Sunday or city holiday, the period runs until 5 p.m. on the next business day.

R103.3.2 Effective date of stop work order. Stop work orders are effective when posted, or if posting is not physically possible, when one of the persons identified in Section R103.3.1 is served or, if notice is mailed, three days after the date of mailing.

R103.3.3 Review of stop work orders by the building official. Any person aggrieved by a stop work order may obtain a review of the order by delivering to the *building official* a request in writing within two business days of the date of service of the stop work order.

R103.3.3.1 Review procedure. The review shall occur within two business days after receipt by the *building official* of the request for review unless otherwise agreed by the person making the request. Any person affected by the stop work order may submit additional information to the *building official* for consideration as part of the review at any time prior to the review. The review will be made by a representative of the *building official* who will review all additional information received and may conduct a site visit.

R103.3.3.2 Decision. After the review, the *building official* may:

1. Sustain the stop work order;
2. Withdraw the stop work order;
3. Modify the stop work order; or
4. Continue the review to a date certain.

R103.3.3.3 Order. The *building official* shall issue an order of the *building official* containing the decision within two business days after the review is completed and shall cause the order to be sent by regular first class mail to the person or persons requesting the review, any person on whom the stop work order was served, and any other person who requested a copy before issuance of the order, addressed to their last known address.

R103.4 Occupancy violations. Whenever any building or structure is being occupied contrary to the provisions of this code, the *building official* may order such occupancy discontinued and the building or structure, or portion thereof, vacated by notice.

R103.4.1 Service of notice of occupancy violation. The notice of occupancy violation shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

R103.4.2 Compliance with notice of occupancy violation. Any person occupying the building or structure shall discontinue the occupancy by the date specified in the notice of the *building official*, or shall make the building or structure, or portion thereof, comply with the requirements of this code; provided, however, that in the event of an unsafe building, Section 102 may apply.

R103.5 Civil penalties. Any person violating or failing to comply with the provisions of this code shall be subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved. In cases where the *building official* has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by the notice of violation.

R103.6 Enforcement in Municipal Court. Civil actions to enforce this chapter shall be brought exclusively in Seattle Municipal Court, except as otherwise required by law or court rule. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of the notice of violation or of an order following a review by the *building official* is not itself evidence that a violation exists.

R103.7 Judicial review. Because civil actions to enforce Seattle Municipal Code (SMC) Title 22 must be brought exclusively in Seattle Municipal Court pursuant to Section R103.6, orders of the *building official* including notices of violation issued under this chapter are not subject to judicial review pursuant to Chapter 36.70C RCW.

R103.8 Alternative criminal penalty. Anyone who violates or fails to comply with any notice of violation or order issued by the *building official* pursuant to this code or who removes, mutilates, destroys or conceals a notice issued or posted by the *building official* shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than 365 days, or by both such fine and imprisonment for each separate violation. Each day's violation shall constitute a separate offense.

R103.9 Additional relief. The *building official* may seek legal or equitable relief to enjoin any acts or practices and abate any condition when necessary to achieve compliance.

R103.10 Administrative review by the building official. Prior to issuance of the building permit, applicants may request administrative review by the *building official* of decisions or actions pertaining to the administration and enforcement of this code. Requests shall be addressed to the *building official*.

R103.11 Administrative review by the Construction Codes Advisory Board. After administrative review by the *building official* and prior to issuance of the building permit, applicants may request review of decisions or actions pertaining to the application and interpretation of this code by the Construction Codes Advisory Board, except for stop work orders, notices of violations and revocations of permits. The review will be performed by three or more members of the Construction Codes Advisory Board, chosen by the Board Chair. The Chair shall consider the subject of the review and members' expertise when selecting members to conduct a review. The decision of the review panel is advisory only; the final decision is made by the *building official*.

R103.12 Recording of notices. The *building official* may record a copy of any order or notice with the Department of Records and Elections of King County.

R103.13 Appeal to Superior Court. Final decisions of the Seattle Municipal Court on enforcement actions authorized by Title 22 may be appealed pursuant to the Rules for Appeal of Decisions of Courts of Limited Jurisdiction.

SECTION R104
ORGANIZATION AND DUTIES

R104.1 Jurisdiction of Department of Construction and Inspections. The Department of Construction and Inspections is authorized to administer and enforce this code. The Department of Construction and Inspections is under the administrative and operational control of the Director, who is the *building official*.

R104.2 Designees. The *building official* may appoint such officers, inspectors, assistants and employees as are authorized from time to time. The *building official* may authorize such employees and other agents as may be necessary to carry out the functions of the *building official*.

R104.3 Right of entry. With the consent of the owner or occupier of a building or premises, or pursuant to a lawfully issued warrant, the *building official* may enter a building or premises at any reasonable time to perform the duties imposed by this code.

R104.4 Impracticality. In cases where compliance with the requirements of this code is impractical, the applicant may arrange a presubmittal conference with the design team and the *building official*. The applicant shall identify alternate design solutions and modifications and demonstrate conformance to Section R104.5 or R104.6. The *building official* is authorized to waive specific requirements in this code that the *building official* determines to be impractical. **

R104.5 Modifications. The *building official* may modify the requirements of this code for individual cases provided the *building official* finds: (1) there are practical difficulties involved in carrying out the provisions of this code; (2) the modification is in conformity with the intent and purpose of this code; and (3) the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety and sanitation when considered together with other safety features of the building or other relevant circumstances. The *building official* may, but is not required to, record the approval of modifications and any relevant information in the files of the *building official* or on the *approved construction documents*.

R104.6 Alternate materials, methods of construction and design. This code does not prevent the use of any material, design or method of construction not specifically allowed or prohibited by this code, provided the alternate has been *approved* and its use authorized by the *building official*. The *building official* may approve an alternate, provided the *building official* finds that the proposed alternate complies with the provisions of this code and that the alternate, when considered together with other safety features of the building or other relevant circumstances, will provide at least an equivalent level of strength, effectiveness, fire resistance, durability, safety and sanitation. Certain code alternates have been pre-*approved* by the *building official* and are identified in this code as code alternates. The *building official* may require that sufficient evidence or proof be submitted to reasonably substantiate any claims regarding the use or suitability of the alternate. The *building official* may, but

is not required to, record the approval of code alternates and any relevant information in the files of the *building official* or on the *approved construction documents*.

R104.7 Flood hazard areas. The *building official* shall not approve modifications or code alternates to any provisions required in flood hazard areas identified in Table R301.2 unless the *building official* has determined that any of the following conditions exist:

1. There is good and sufficient cause showing that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section R322 inappropriate.
2. Failure to approve the modification or code alternate would result in exceptional hardship.
3. The approval of the modification or code alternate will not result in increased flood heights, additional threats to public safety, or additional public expense.

Any modification or code alternate that is *approved* shall be the minimum necessary to afford relief, considering the flood hazard.

If a modification or code alternate is *approved*, the *building official* shall give written notice to the applicant that describes the difference between the design flood elevation and the elevation to which the building is to be built, warns that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and states that construction below the design flood elevation increases risks to life and property.

R104.8 Tests. Whenever there is insufficient evidence of compliance with any of the provisions of this code or evidence that any material or construction does not conform to the requirements of this code, the *building official* may require tests as proof of compliance to be made at no expense to the City. Test methods shall be specified by this code or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the *building official* shall determine the test procedures. All tests shall be made by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

R104.9 Rules of the building official. The *building official* has authority to issue interpretations of this code and to adopt and enforce rules and regulations supplemental to this code as may be deemed necessary in order to clarify the application of the provisions of this code. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this code.

R104.9.1 Procedure. The *building official* shall promulgate, adopt and issue rules according to the procedures specified in the Administrative Code, Chapter 3.02 of the *Seattle Municipal Code*.

R104.10 Liability. Nothing in this code is intended to be nor shall be construed to create or form the basis for any liability on the part of the City, or its officers, employees or agents, for any injury or damage resulting from the failure of a building to conform to the provisions of this code, or by reason or as a consequence of any inspection, notice, order, certificate, permission or approval authorized or issued or done in connection with the implementation or enforcement of this code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this code by its officers, employees or agents.

This code shall not be construed to relieve or lessen the responsibility of any person owning, operating or controlling any building or structure for any damages to persons or property caused by defects, nor shall the Department of Construction and Inspections or the City of Seattle be held to have assumed any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

R104.11 Responsibilities of parties.

R104.11.1 Responsibility for compliance. Compliance with the requirements of this code is the obligation of the owner of the building, structure, or premises; the duly authorized agent of the owner; and other persons responsible for the condition or work, and not of the City or any of its officers, employees or agents.

R104.11.2 Responsibility of design professional, contractor, plans examiner and inspector. The responsibilities of the *design professional* in responsible charge, contractor, plans examiner, and field inspector are as provided in the *International Building Code* Section 104.10.

SECTION R105
BUILDING PERMITS

R105.1 Permits required. Except as otherwise specifically provided in this code, a building permit shall be obtained from the *building official* for each building or structure prior to erecting, constructing, enlarging, altering, repairing, moving, improving, removing, changing the occupancy of, or demolishing such building or structure, or allowing the same to be done. All work shall comply with this code, even where no permit is required.

R105.2 Work exempt from permit. A building permit is not required for the work listed below. Exemption from the permit requirements of this code does not authorize any work to be done in any manner in violation of this code or any other laws or ordinances of the City.

1. Minor repairs or *alterations* if the value of construction, as determined by the *building official*, is $6,000 or less in any six month period. Such repairs and *alterations* shall not include the removal, reduction, *alteration* or relocation of any loadbearing support. Egress, light, ventilation and fire-resistance shall not be reduced without a permit.
2. Minor work including the following, provided no changes are made to the building envelope: patio and concrete slabs on grade; painting or cleaning a building; repointing a chimney; installing kitchen cabinets, paneling or other surface finishes over existing wall and ceiling systems; insulating existing buildings; abatement of hazardous materials; and in-kind or similar replacement of or repair of deteriorated members of a structure.
3. One-story detached accessory buildings used for greenhouse, tool or storage shed, playhouse, or similar uses, if:
   3.1. The projected roof area does not exceed 120 square feet; and
   3.2. The building is not placed on a concrete foundation other than a slab on grade.
4. Fences not over 8 feet high that do not have masonry or concrete elements above 6 feet.
5. Arbors and other open-framed landscape structures not exceeding 120 square feet in projected area.
6. Retaining walls and rockeries which are not over 4 feet in height measured from the bottom of the footing to the top of the wall, if:
   6.1. There is no surcharge or impoundment of Class I, II or III-A liquids;
   6.2. The wall or rockery is not located in an Environmentally Critical Area (ECA) or ECA buffer pursuant to chapter 25.09 of the *Seattle Municipal Code*;
   6.3. Construction does not support soils in a steep slope area, potential landslide area or known slide area as identified in the Seattle Environmentally Critical Areas Ordinance, Section 25.09.030 of the *Seattle Municipal Code*.
   6.4. Possible failure would likely cause no damage to adjoining property or structures.
7. Platforms, walks and driveways not more than 18 inches above grade and not over any *basement* or story below.
8. Window awnings supported by an *exterior wall* when projecting not more than 54 inches.
9. Prefabricated swimming pools, spas and similar *equipment* accessory to a building subject to this code in which the pool walls are entirely above the adjacent grade and if the capacity does not exceed 5,000 gallons.
10. Replacement of siding. This shall not include structural changes, replacement of sheathing or *alteration* to doors and windows. See Energy Code Sections R503.1.1, Exceptions 2 and 3.
11. Roof recover.
12. Roof replacement if no changes are made to the building envelope other than adding or replacing insulation, and the work is equivalent to or better than the existing structure. Permits are required for structural changes and replacement of sheathing of any size. See Energy Code Sections R503.1.1, Exceptions 2 and 3 for insulation requirements for existing buildings.
13. Private playground *equipment* including tree houses.
14. Removal and/or replacement of underground storage tanks that are subject to regulation by a state or federal agency.

Note: A Fire Department permit is required for removal, replacement and decommissioning of underground storage tanks.

15. Installation of dish and panel antennas 6.56 feet (2 m) or less in diameter or diagonal measurement.
16. Portable heating *appliances*, portable ventilating *equipment* and portable cooling units, if the total capacity of these portable *appliances* does not exceed 40 percent of the cumulative heating, cooling or ventilating requirements of a building or *dwelling unit* and does not exceed 3 kW or 10,000 Btu input.
17. Any closed system of steam, hot or chilled water *piping* within heating or cooling *equipment* regulated by this code.
18. Minor work or the replacement of any component part of a mechanical system that does not alter its original approval and complies with other applicable requirements of this code.
19. Water tanks not located in Environmentally Critical Areas that are supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) the ratio of height to diameter or width is not greater than 2:1.

R105.3 Other permits required. Unless otherwise exempted by this or other pertinent codes, separate master use, plumbing, electrical, mechanical and other permits may be required for the above exempted items.

R105.4 Flood hazard areas. In addition to the permit required by this section, all work to be performed in areas of special flood hazard, as defined in Chapter 25.06 of the *Seattle Municipal Code* are subject to additional standards and requirements, including floodplain development approval or a Floodplain Development License, as set forth in Chapter 25.06, the Seattle Floodplain Development Ordinance.

R105.5 Application for permit. To obtain a permit, the applicant shall first file an application in a format determined by the *building official*. Every such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, property address or similar description that will readily identify and definitely locate the proposed building or work.
3. Provide the contractor's business name, address, phone number and current contractor registration number (required if contractor has been selected).
4. Be accompanied by *construction documents*, including plans and other data required in Section R105.6.
5. State the valuation of any new building or structure or any addition, remodeling or *alteration* to an existing building, including cost breakdown between additions and *alterations*.
6. Be signed by the owner of the property or building, or the owner's authorized agent, who may be required to submit evidence to indicate such authority.
7. Give such other data and information as may be required by the *building official*, including, but not limited to, master use and shoreline permits and building identification plans.
8. State the name of the owner and contractor and the name, address and phone number of a contact person.
9. Substantially conform with applicable city law in effect on the date described in Section R101.3, as modified by any exception.
10. Applications that include a grading component shall include all information prescribed by the Grading Code and rules adopted thereunder, and all additional information required by the *building official* pursuant to the Grading Code and rules adopted thereunder.

R105.6 Submittal documents. Submittal documents consisting of *construction documents* and other data shall be submitted in two or more sets, or in a digital format where allowed by the building official, with each application for a *permit*. The *construction documents* shall be prepared by a registered *design professional* where required by the statutes of the *jurisdiction* in which the project is to be constructed. Computations, stress diagrams, shop and fabrication drawings and other data sufficient to show the adequacy of the plans shall be submitted when required by the *building official*. Where special conditions exist, the *building official* is authorized to require additional *construction documents* to be prepared by a registered *design professional*.

Exception: The *building official* is authorized to waive the submission of *construction documents* and other data not required to be prepared by a registered *design professional* if it is found that the nature of the work applied for is such that reviewing of *construction documents* is not necessary to obtain compliance with this code.

R105.6.1 Preparation by registered design professionals. *Construction documents* for all work shall be prepared and designed by or under the direct supervision of an architect or structural engineer licensed to practice under the laws of the State of Washington. The registered *design professional* shall apply their seal and signature to each sheet of the construction documents that is within their scope of qualifications before the permit is issued.

Exceptions:

1. When authorized by the *building official*, *construction documents* need not be prepared by an engineer or architect licensed by the State of Washington for the following:
   1.1. Detached one- and two-family dwellings.
   1.2. New buildings or structures, and additions, *alterations* or repairs made to them of wood light-frame construction, if the value of construction, as determined by the *building official*, is less than $75,000.
   1.3. Nonstructural *alterations* and repairs if the value of construction, as determined by the *building official*, is less than $75,000, excluding the value of electrical and mechanical systems, fixtures, *equipment*, interior finish and millwork.
   1.4. Other work as specified in rules promulgated by the *building official*.
2. When authorized by the *building official*, *construction documents* for assembly line products or designed specialty structural products may be designed by a registered professional engineer.

Interpretation R105.6: Exception 1 does not include buildings with steel moment frames, or extensive or more complex concrete structures such as concrete frame, mild reinforced or post-tensioned floor slabs. These buildings are required to be designed by a licensed structural engineer.

R105.6.1.1 Design professional in responsible charge. The *building official* is authorized to require the owner to engage and designate on the building permit application a registered *design professional* who shall act as the registered *design professional* in responsible charge. If the circumstances require, the owner shall designate a substitute registered *design professional* in responsible charge who shall perform the duties required of the original registered *design professional* in responsible charge. The *building official* shall be notified in writing by the owner if the registered *design professional* in responsible charge is changed or is unable to continue to perform the duties. The registered *design professional* in responsible charge is responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.

R105.6.2 Information required on construction documents. *Construction documents* shall include the following, as applicable:

1. A plot plan showing the width of streets, alleys, *yards* and courts.
2. The location (and/or location within a building), floor area, story, height and use defined by the Land Use Code of the proposed building and of every existing building on the property.
3. Where there are more than two buildings located on a property, a building identification plan identifying the location of each building on the property and identifying each building by a numbering system unrelated to address. Such plan is not required where a plan for the site is already on file and no new buildings are being added to the site.
4. Types of heating and air conditioning systems.
5. Architectural plans, including floor plans, elevations and door and finish schedules showing location of all doors, windows, mechanical *equipment*, shafts, pipes, vents and ducts.
6. Structural plans, including foundation plan and framing plans.
7. Cross-sections and construction details for both architectural and structural plans, including wall sections, foundation, floor and roof details, connections of structural members and types of construction material.
8. Topographic plans, including original and final contours, location of all buildings and structures on the site and, when required by the *building official*, adjacent to the site, and cubic yards of cut and fill.
9. If the *building official* has reason to believe that there may be an intrusion into required open areas or over the property line, a survey of the property prepared by a land surveyor licensed by the State of Washington is required for all new construction, and for additions or accessory buildings.
10. If any building or structure is to be erected or constructed on property abutting an unimproved or partially improved street or alley, the plans shall also include a profile showing the established or proposed grade of the street or alley, based upon information obtained from the Director of Transportation relating to the proposed finished elevations of the property and improvements thereon.

R105.6.3 Information on first sheet. The first or general note sheet of each set of plans shall specify the following, as applicable:

1. The building and street address of the work.
2. The name and address of the owner and person who prepared the plans.
3. Legal description of the property.
4. Type of occupancy of all parts of the building as defined in this code, including notation of fixed fire protection devices or systems.
5. Zoning classification of the property and existing and proposed uses of the structure(s) as defined in the *Land Use Code*.
6. Number of stories and *basements* as defined in this code.
7. Variances, conditional uses, special exceptions, including project numbers, approval and approval extension dates.

R105.6.4 Structural notes. Plans shall include applicable information including, but not limited to, the following:

1. Design loads: Snow load, live loads and lateral loads. If required by the *building official*, the structural notes for plans engineered to ASCE 7 shall include the factors of the base shear formula used in the design;
2. Foundations: Foundation investigations, allowable bearing pressure for spread footings, allowable load capacity of piles, lateral earth pressure;

3. Masonry: Type and strength of units, strength or proportions of mortar and grout, type and strength of reinforcement, method of testing, design strength;
4. Wood: Species or species groups, and grades of sawn lumber, glued-laminated lumber, plywood and assemblies, type of fasteners;
5. Concrete: Design strengths, mix designs, type and strength of reinforcing steel, welding of reinforcing steel, restrictions, if any; and
6. Steel and aluminum: Specification types, grades and strengths, welding electrode types and strengths.

In lieu of detailed structural notes, the *building official* may approve minor references on the plans to a specific section or part of this code or other ordinances or laws.

R105.6.5 Deferred submittals. Deferral of any submittal items shall have the prior approval of the *building official*. The *registered design professional in responsible charge* shall list *deferred submittals* on the *plans* for review by the *building official*.

Documents for *deferred submittal* items shall be submitted to the *registered design professional in responsible charge* who shall review them and forward them to the *building official* with a notation indicating that the *deferred submittal* documents have been reviewed and been found to be in general conformance to the design of the building. The *deferred submittal* items shall not be installed until the *deferred submittal* documents have been *approved* by the *building official*.

R105.6.6 Information for construction in flood hazard areas. For buildings and structures located in whole or in part in flood hazard areas identified in Table R301.2, *construction documents* shall also include:

1. Delineation of flood hazard areas, floodway boundaries, flood zones, and design flood elevations, as appropriate.
2. The elevation of the proposed lowest floor, including *basement*; and in areas of shallow flooding (AO Zones), the height of the proposed lowest floor, including *basement*, above the highest adjacent *grade*.
3. The elevation of the bottom of the lowest horizontal structural member in coastal high hazard areas (V Zone) and in Coastal A Zones where such zones are delineated on flood hazard maps identified in Table R301.2 or otherwise delineated by the *jurisdiction*.
4. If design flood elevations are not included on the community's Flood Insurance Rate Map (FIRM), the *building official* and the applicant shall obtain and reasonably utilize any design flood elevation and floodway data available from other sources.

R105.6.7 Construction and demolition waste. The information in Sections R105.6.7.1 and R105.6.7.2 shall be submitted for projects generating construction or demolition material for salvage, recycling or disposal:

Exception: Projects for which an emergency order or hazard correction order has been issued pursuant to Section R102.

R105.6.7.1 Application submittal requirements. The following information shall be provided at the time of application submittal for *building alterations* and the demolition of *existing buildings* having a work area greater than 750 square feet or a project value greater than $75,000:

1. A salvage assessment completed by an *approved agency* identifying building components having potential to be salvaged prior to building removal. The building owner is permitted to complete the assessment for building *alterations* that include some demolition.
2. A statement of compliance with the regulations of the Puget Sound Clean Air Agency regarding asbestos identification, notification, and abatement.

R105.6.7.2 Waste Diversion Report. A Waste Diversion Report shall be submitted within 60 days of final inspection approval. The Waste Diversion Report shall identify the weight or volume of project-generated construction waste and demolition material; the hauler of the material; and the receiving facility or location for each commodity. A signed affidavit from the receiving party and photo documentation shall be included for salvaged materials in which a tip receipt cannot be obtained.

R105.6.8 Clarity of plans. Plans shall be drawn to a clearly indicated and commonly accepted scale in a format determined by the *building official.*

R105.7 Application review. The *construction documents* shall be reviewed by the *building official*. Such *construction documents* may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction.

R105.7.1 Determination of completeness. Within 28 days after an application is filed, the *building official* shall notify the applicant in writing either that the application is complete or that it is not complete, and if not complete, what additional information is required to make it complete. Within 14 days after receiving the additional information, the *building official* shall notify the applicant in writing whether the application is now complete or what additional information is necessary.

An application shall be deemed to be complete if the *building official* does not notify the applicant in writing by the deadlines in this section that the application is incomplete.

R105.7.2 Decision on application. Except as provided in Section R105.10, the *building official* shall approve, condition or deny the application within 120 days after the *building official* notifies the applicant that the application is complete.

To determine the number of days that have elapsed after the notification that the application is complete, the following periods shall be excluded:

1. All periods of time during which the applicant has been requested by the Director to correct plans, perform required studies, or provide additional required information, until the determination that the request has been satisfied. The period shall be calculated from the date the *building official* notifies the applicant of the need for additional information until the earlier of the date the *building official* determines whether the additional information satisfies the request for information or 14 days after the date the information has been provided to the *building official*.
2. If the *building official* determines that the information submitted by the applicant under item 1 of this subsection is insufficient, the *building official* shall notify the applicant of the deficiencies, and the procedures under item 1 of this subsection shall apply as if a new request for information had been made;
3. All extensions of time mutually agreed upon by the applicant and the *building official*.

If a project permit application is substantially revised by the applicant, the time period shall start from the date at which the revised project application is determined to be complete under Section R101.3.1.

R105.7.3 Determination of substantially improved or substantially damaged existing buildings in flood hazard areas. For applications for reconstruction, rehabilitation, *addition*, *alteration*, repair or other improvement of existing buildings or structures located in a flood hazard area identified in Table R301.2, the *building official* shall determine the value of the proposed work. For buildings that have sustained damage of any origin, the value of the proposed work shall include the cost to repair the building or structure to its predamaged condition, regardless of the actual repair work performed. If the *building official* finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure before the damage occurred or the improvement starts, the proposed work constitutes a substantial improvement and the proposed work shall comply with Section R322.

Substantial improvements do not include:

1. Improvements to a building or structure that are required to correct existing health, sanitary or safety code violations identified by the *building official* and that are the minimum necessary to ensure safe living conditions; or
2. Any *alteration* of a landmark, provided that the *alteration* will not result in rescission of the landmark's landmark designation.

Interpretation R105.7.3: The value of all improvements over a five-year period shall be considered part of the proposed work for the purpose of determining substantial improvement.

R105.8 Issuance of permit.

R105.8.1 Subject to Section R105.8.2, the *building official* shall issue a permit to the applicant if the *building official* finds the following:

1. The work described in the *construction documents* conforms to the requirements of this code and other pertinent laws, ordinances and regulations and with all conditions imposed under any of them;
2. The fees specified in the Fee Subtitle have been paid; and
3. The applicant has complied with all requirements to be performed prior to issuance of a permit for the work under other pertinent laws, ordinances or regulations or included in a master use permit, or otherwise imposed by the *building official*.

When the permit is issued, the applicant or the applicant's authorized agent becomes the permit holder.

R105.8.2 The *building official* shall not issue a permit if the *building official* has determined that the property owner violated subsection 22.210.136.A of the Seattle Municipal Code and has not obtained any required tenant relocation license.

R105.8.3 Grading permits. The grading component of the building permit is the portion of the building permit that authorizes work that is subject to the requirements of the Grading Code. That component constitutes a grading permit.

R105.8.4 Permit conditions. The *building official* may impose on a permit any conditions authorized by this code or other pertinent ordinances or regulations, including but not limited to the Grading Code, the Stormwater Code, Regulations for Environmentally Critical Areas, and rules adopted pursuant to those codes. The *building official* may condition a permit in order to reduce the risks associated with development, construction, ownership and occupancy including, but not limited to risks in potential slide areas.

R105.8.5 Denial of permits. The *building official* may deny a permit if the *building official* determines that:

1. The risks cannot be reduced to an acceptable level;
2. The proposed project or *construction documents* do not conform to the requirements of this code or other pertinent laws, ordinances or regulations, to requirements included in the Master Use Permit or to requirements otherwise imposed by the *building official* or other City departments, or to requirements otherwise imposed by the *building official* or other City departments; or
3. The applicant has failed to comply with any requirement or condition imposed pursuant to the authority described in Section R105.8.4.

R105.8.6 Compliance with approved construction documents. When the *building official* issues a permit, the *building official* shall endorse the permit in writing or in electronic format and stamp the plans APPROVED. Such *approved* plans and permit shall not be changed, modified or altered without authorization from the *building official*, and all work shall be done in accordance with the *approved construction documents* and permit except as authorized by the *building official* during a field inspection to correct errors or omissions, or as authorized by Section R105.9.

R105.9 Revisions to the permit. When changes to the *approved* work are made during construction, approval of the *building official* shall be obtained prior to execution. The building inspector may approve minor changes to the *construction documents* for work not reducing the structural strength or fire and life safety of the structure. The building inspector shall determine if it is necessary to revise the *approved construction documents*. No changes that are subject to special inspection shall be made during construction unless *approved* by the *building official*. If revised plans are required, changes shall be submitted to and *approved* by the *building official*, accompanied by fees specified in the Fee Subtitle, prior to occupancy. All changes shall conform to the requirements of this code and other pertinent laws and ordinances and other issued permits.

R105.10 Cancellation of permit applications. Applications may be cancelled if no permit is issued by the earlier of the following: (1) 12 months following the date of application; or (2) 60 days from the date of written notice that the permit is ready to issue. After cancellation, *construction documents* submitted for review may be returned to the applicant or destroyed by the *building official.*

The *building official* will notify the applicant in writing at least 30 days before the application is cancelled. The notice shall specify a date by which a request for extension must be submitted in order to avoid cancellation. The date shall be at least two weeks prior to the date on which the application will be cancelled.

R105.10.1 Extensions prior to permit issuance. At the discretion of the *building official*, applications for projects that require more than 12 months to review and approve may be extended for a period that provides reasonable time to complete the review and approval, but in no case longer than 24 months from the date of the original application. No application may be extended more than once. After cancellation, the applicant shall submit a new application and pay a new fee to restart the permit process.

Notwithstanding other provisions of this code, an application may be extended where issuance of the permit is delayed by litigation, preparation of environmental impact statements, appeals, strikes or other causes related to the application that are beyond the applicant's control, or while the applicant is making progress toward issuance of a master use permit.

R105.11 Retention of plans. One set of *approved* plans, which may be on microfilm or in electronic format, shall be retained by the *building official*. One set of *approved* plans shall be returned to the applicant and shall be kept at the site of the building or work for use by inspection personnel at all times during which the work authorized is in progress.

R105.12 Validity of permit. The issuance or granting of a permit or approval of *construction documents* shall:

1. Not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or other pertinent laws and ordinances;
2. Not prevent the *building official* from requiring the correction of errors in the *construction documents* or from preventing building operations being carried on thereunder when in violation of this code or of other pertinent laws and ordinances of the City;
3. Not prevent the *building official* from requiring correction of conditions found to be in violation of this code or other pertinent laws and ordinances of the City; or
4. Not be construed to extend the period of time for which any such permit is issued or otherwise affect any period of time for compliance specified in any notice or order issued by the *building official* or other administrative authority requiring the correction of any such conditions.

R105.13 Expiration of permits. Authority to do the work authorized by a permit expires 18 months from the date of issuance. An *approved* renewal extends the life of the permit for an additional 18 months from the prior expiration date. An *approved* reestablishment extends the life of the permit for 18 months from the date the permit expired.

Exceptions:

1. Initial permits for major construction projects that require more than 18 months to complete may be issued for a period that provides reasonable time to complete the work, according to an *approved* construction schedule. The *building official* may authorize a permit expiration date not to exceed three years from the date of issuance, except when there is an associated Shoreline Substantial Development permit in which case the *building official* may authorize an expiration date not to exceed the life of the Shoreline permit.
2. The *building official* may issue permits which expire in less than 18 months if the *building official* determines a shorter period is appropriate to complete the work.

This section is subject to the limitations in *Seattle Municipal Code* Section 22.800.100, Seattle Stormwater Code.

R105.14 Renewal of permits. Permits may be renewed and renewed permits may be further renewed by the *building official* if the following conditions are met:

1. Application for renewal is made within the 30-day period immediately preceding the date of expiration of the permit; and
2. If the project has had an associated discretionary Land Use review, the land use approval has not expired; and
3. If an application for renewal is made more than 18 months after the date of mandatory compliance with a new or revised edition of the *Seattle Residential Code*, the permit shall not be renewed unless:
   3.1. The *building official* determines that the permit complies, or is modified to comply, with the Seattle Residential, Energy, Stormwater, Side Sewer and Grading codes in effect on the date of application for renewal; or
   3.2. The work authorized by the permit is substantially underway and progressing at a rate *approved* by the *building official*. "Substantially underway" means that normally required building inspections have been *approved* for work such as foundations, framing, mechanical, insulation and finish work that is being completed on a continuing basis; or
   3.3. Commencement or completion of the work authorized by the permit is delayed by litigation, appeals, strikes or other extraordinary circumstances related to the work authorized by the permit beyond the permit holder's control, subject to approval by the *building official*; and
4. The permit shall not be renewed unless: (a) the *building official* determines that the permit complies, or is modified to comply, with the Seattle Stormwater Code in effect on the date of application for renewal; or (b) construction has started. For purposes of this provision, "started construction" means the site work associated with and directly related to the *approved* project has begun. For example, grading the project site to final grade or utility installation constitutes the start of construction; simply clearing the project site does not.

R105.15 Reestablishment of expired permits. A new permit is required to complete work if a permit has expired and was not renewed.

Exception: A permit that expired less than one year prior to the date of a request for reestablishment may be reestablished upon approval of the *building official* if it complies with Section R105.14, Items 2, 3 and 4 above. Once re-established the permit will not be considered to have expired. The new expiration date of a reestablished permit shall be determined in accordance with Section R105.13.

R105.16 Revocation of building permits. Whenever the *building official* determines there are grounds for revoking a permit, the *building official* may issue a notice of revocation. The notice of revocation shall identify the reason for the proposed revocation, including but not limited to the violations, the conditions violated and any alleged false or misleading information provided.

R105.16.1 Standards for revocation. The *building official* may revoke a permit if:

1. The code or the building permit has been or is being violated and issuance of a notice of violation or stop work order has been or would be ineffective to secure compliance because of circumstances related to the violation; or
2. The permit was obtained with false or misleading information.

R105.16.2 Service of notice of revocation. The notice of revocation shall be served upon the owner, agent or other responsible person by personal service or regular first class mail addressed to the last known address of such person or if no address is available after reasonable inquiry, the notice may be posted in a conspicuous place on the premises. The notice may also be posted if served by personal service or first class mail.

R105.16.3 Effective date of revocation. The *building official* shall identify in the notice of revocation a date certain on which the revocation will take effect. This date may be stayed pending complete review by the *building official* pursuant to Section R105.12.4.

R105.16.4 Review by the building official for notice of revocation. Any person aggrieved by a notice of revocation may obtain a review by making a request in writing to the *building official* within three business days of the date of service of the

notice of revocation. Any person affected by the notice of revocation may submit additional information to the *building official* for consideration as part of the review at any time prior to the review.

R105.16.4.1 Review procedure. The review will be made by a representative of the *building official* who will review all additional information received and may also request a site visit. After the review, the *building official* may:

1. Sustain the notice of revocation and affirm or modify the date the revocation will take effect;
2. Withdraw the notice of revocation;
3. Modify the notice of revocation and affirm or modify the date the revocation will take effect; or
4. Continue the review to a date certain.

R105.16.4.2 Order of revocation of permit. The *building official* shall issue an order containing the decision within ten days after the review is completed and shall cause the same to be sent by regular first class mail to the person or persons requesting the review, any other person on whom the notice of revocation was served and any other person who requested a copy before issuance of the order. The order of the *building official* is the final order of the City, and the City and all parties shall be bound by the order.

SECTION R106
INSPECTIONS

R106.1 General. All construction or work for which a permit is required is subject to inspection by the *building official*, and certain types of construction shall have special inspections by registered special inspectors as specified in the *Seattle Building Code* Chapter 17.

R106.2 Surveys. A survey of the *lot* may be required by the *building official* to verify compliance of the structure with *approved construction documents*.

R106.3 Inspection requests. The owner of the property or the owner's authorized agent, or the person designated by the owner or agent to do the work authorized by a permit shall notify the *building official* that work requiring inspection as specified in this section is ready for inspection.

R106.4 Access for inspection. The permit holder and the person requesting any inspections required by this code shall provide access to and means for proper inspection of such work, including safety *equipment* required by the Washington Industrial Safety and Health Agency. The work shall remain accessible and exposed for inspection purposes until *approved* by the *building official*. Neither the *building official* nor the City is liable for expense entailed in the required removal or replacement of any material to allow inspection.

R106.5 Inspection record. Work requiring a permit shall not be commenced until the permit holder or the permit holder's agent has posted an inspection record in a conspicuous place on the premises and in a position that allows the *building official* to conveniently make the required entries regarding inspection of the work. This record shall be maintained in such a position by the permit holder or the permit holder's agent until final approval has been granted by the *building official*.

R106.6 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the *building official*. Written approval shall be given only after an inspection has been made of each successive step in the construction as indicated by each of the inspections required in Section R106.8. There shall be a final inspection and approval of all buildings when they are completed and ready for occupancy.

R106.6.1 Effect of approval. Approval as a result of an inspection is not approval of any violation of the provisions of this code or of other pertinent laws and ordinances of the City. Inspections presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

R106.7 Concealment of work. No required reinforcing steel or structural framework of any part of a building or structure shall be covered or concealed in any manner whatsoever without first obtaining the approval of the *building official*.

Exception: Modular homes and commercial coaches identified by State of Washington stickers specified in Section 106.13.4 of the *International Building Code* and placed upon a permanent foundation *approved* and inspected by the *building official*.

R106.8 Required inspections. The *building official*, upon notification by the permit holder or the permit holder's agent, of the property address and permit number, shall make the following inspections and shall either approve that portion of the construction as completed or shall notify the permit holder or the permit holder's agent if the construction fails to comply with the law.

R106.8.1 First ground disturbance inspection. To be made prior to beginning land-disturbing activity, and following installation of erosion control measures and any required fencing that may restrict land disturbance in steep slope or other buffers as defined in chapter 25.09 of the *Seattle Municipal Code*.

Note: The purpose of the site inspection is to verify the erosion control method, location and proper installation. *Approved* drainage plan requirements and site plan conditions will also be verified, including buffer delineations.

R106.8.2 Foundation inspection. To be made after trenches are excavated and forms erected and when all materials for the foundation are delivered on the job. Where concrete from a central mixing plant (commonly termed "ready mix") is to be used, materials need not be on the job.

R106.8.3 Concrete slab or under-floor inspection. To be made after all in-slab or under-floor building service *equipment*, conduit, *piping* accessories and other ancillary *equipment* items are in place but before any concrete is poured or floor sheathing installed, including the subfloor.

R106.8.4 Floodplain inspections. For construction in flood hazard areas identified in Table R301.2, upon placement of the lowest floor, including *basement*, and prior to further vertical construction, the applicant shall submit documentation, prepared and sealed by a registered *design professional*, showing the elevation of the lowest floor, including *basement*, as required in Section R322.

R106.8.5 Frame inspection. To be made after the roof, all framing, fireblocking and bracing are in place and all pipes, chimneys and vents are complete and the rough electrical, plumbing and heating wires, pipes and ducts are *approved*.

R106.8.6 Insulation inspection. To be made after all insulation and vapor barriers are in place but before any gypsum board or plaster is applied.

R106.8.7 Lath and/or gypsum board inspection. For shear walls, to be made after lathing and/or gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.

R106.8.8 Final site inspection. To be made after all grading is complete, and all permanent erosion controls, stormwater facilities and stormwater best management practices have been installed.

Exception: A final site inspection is not required for projects with less than 750 square feet of land disturbing activity.

R106.8.9 Final inspection. To be made after finish grading and the building is completed and before occupancy.

R106.8.9.1 Elevation documentation. If located in a flood hazard area, the documentation of elevations required in Section R322.1.10 shall be submitted to the *building official* prior to the final inspection.

R106.9 Special inspection. Special inspection shall be provided in accordance with *International Building Code* Chapter 17.

R106.10 Other inspections. In addition to the inspections specified above, the *building official* may make or require any other inspections of any construction work or site work to ascertain compliance with the provisions of this code and other pertinent laws and ordinances that are enforced by the *building official*.

R106.11 Special investigation. If work that requires a permit or approval is commenced or performed prior to making formal application and receiving the *building official's* permission to proceed, the *building official* may make a special investigation inspection before a permit is issued for such work. Where a special investigation is made, a special investigation fee may be assessed in accordance with the Fee Subtitle.

R106.12 Reinspections. The *building official* may require a reinspection if work for which an inspection is called is not complete, required corrections are not made, the inspection record is not properly posted on the work site, the *approved* plans are not readily available to the inspector, access is not provided on the date for which inspection is requested, or if deviations from *construction documents* that require the approval of the *building official* have been made without proper approval, or as otherwise required by the *building official*.

R106.12.1 Compliance with Section R107.3. For the purpose of determining compliance with Section R107.3, Maintenance, the *building official* or the fire chief may cause a structure to be reinspected.

R106.12.2 Reinspection fee. The *building official* may assess a reinspection fee as set forth in the Fee Subtitle for any action for which reinspection is required. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

R106.13 Approval for occupancy. Except for *alterations* and additions, no building or structure subject to this code shall be occupied until *approved* for occupancy after final inspection.

R106.13.1 Effect of final inspection. Final inspection is not an approval of any violation of the provisions of this code or other pertinent laws and ordinances of the City. Certificates presuming to give authority to violate or cancel the provisions of this code or of other pertinent laws and ordinances of the City are not valid.

SECTION R107
EXISTING STRUCTURES AND EQUIPMENT

R107.1 General. Buildings and structures in existence at the time of the passage of this code that were legally constructed and occupied in accordance with the provisions of a prior code may continue their existing use, if such use is not unsafe.

Mechanical, electrical, plumbing, fire protection and life safety systems lawful at the time of the adoption of this code may continue and may be maintained or repaired, converted to another type of fuel or have components replaced if it is done in accordance with the basic original design and location and no hazard to life, health or property is created by such system. ** Additions, *alterations* or repairs may be made to any mechanical, electrical, plumbing, fire protection and life safety systems without requiring the existing system to comply with all the requirements of this code, if the addition, *alteration* or repair conforms to the standards required for a new system. Minor additions, *alterations* and repairs to existing mechanical, electrical, plumbing, fire protection and life safety systems may be installed in accordance with the law in effect at the time the original installation was made, if *approved* by the *building official*.

** *Additions*, *alterations*, change of use, *repairs* or relocations of existing buildings and structures shall conform with the provisions of this Chapter and Chapter 44, as applicable. Any building or addition that is not covered by or within the scope of this code as provided in Section R101.2 shall be designed to the provisions of the *International Building Code*.

R107.2 Establishing existing uses for the record. In order to establish an existing use for the record, the building shall comply with the fire and life safety requirements of this code or the code effective at the time the building was constructed. If the existing use is other than that for which the building was constructed, the building shall comply with this code or the code effective at the time the existing use was legally established.

R107.3 Maintenance. All buildings and structures, and all parts thereof, shall be maintained in a safe and sanitary condition. All mechanical systems, materials, *equipment* and appurtenances and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and hazard-free condition. All devices and safeguards which are or were required by a code in effect when the building or structure was erected, altered or repaired shall be maintained in conformance with the code edition under which installed.

Exception: The *building official* is authorized to modify the requirements of this subsection where all or a portion of a building is unoccupied, closed off and reasonably secure from unlawful entry.

R107.3.1 Reinspection for maintenance. To determine compliance with this subsection, the *building official* may cause a mechanical system or *equipment* to be reinspected.

R107.3.2 Responsibility for maintenance. The owner or the owner's designated agent is responsible for maintenance of buildings, structures, mechanical systems, materials, *equipment*, devices, safeguards and appurtenances. It is a violation to fail to maintain such buildings, structures, mechanical systems, materials, *equipment,* devices, safeguards and appurtenances or to fail to immediately comply with any lawful notice or order of the *building official*.

Exception: Occupants of dwellings are responsible for the maintenance of smoke alarms required by Section R314 and carbon monoxide alarms required by Section R315.

* **[W] R107.4 Additions, alterations, change of use, repairs or relocations.** Additions, *alterations*, change of use, repairs, or relocations shall be permitted to conform to the requirements of the provisions of Chapter 44 or shall conform to the requirements of this code unless otherwise stated. Additions, alterations, change of use, repairs, and relocations shall not cause an *existing* structure to become less compliant with the provisions of this code than the existing building or structure was prior to the addition, alteration, change of use, repair, or relocation. Where additions, alterations, or changes of use to an existing structure result in a use or occupancy, height, or means of egress outside the scope of this code, the building shall comply with the International Existing Building Code.

* See also applicable provisions of the *International Energy Conservation Code*.

Exceptions:

1. An addition may be made to an existing nonconforming building if the following conditions are met:
   1.1. A fire wall, constructed in compliance with *International Building Code* Section 706, separates the addition and the existing structure;
   1.2. The existing building is not made more nonconforming; and
   1.3. The addition conforms to this code.
2. Additions with less than 500 square feet of conditioned floor area are exempt from the requirements for whole house ventilation systems, Section M1505.4.

* **R107.5 Additional requirements.** All *additions*, *alterations*, change of use, *repairs*, or relocations of existing structures and buildings shall also comply Sections 107.5.1 through 107.6.3, as applicable.

R107.5.1 Substantial alterations or repairs. Any building or structure, including relocated structures, to which substantial *alterations* or repairs are made shall conform to the requirements of this Section and Sections R310 (emergency escape and rescue openings), R311 (means of egress), R314 (smoke and heat detection alarms), R315 (carbon monoxide alarms) and R302.2 through R302.4 (*dwelling unit* separation). **

R107.5.1.1 Definition. For the purpose of this section, substantial *alterations* or repairs may mean any one of the following, as determined by the *building official*:

1. Repair of buildings with *damage ratios* of 60 percent or more.
2. Remodeling or additions that substantially extend the useful physical and/or economic life of the building or a significant portion of the building.
3. Change to a use within the scope of this code from a use not within the scope of this code.
4. Change from an *accessory structure* to any other use within the scope of this code.
5. Change from a detached one- or two-family dwelling to a townhouse.
6. Change to *adult family home* or family child day care home from any other use.

R107.5.1.2 Seismic regulations. Buildings or structures to which substantial *alterations* or repairs are made shall comply with Sections R301.1.3 or Sections R403.1.6, R602.10 and R602.11. In addition, the *building official* may require testing of existing materials, at applicant or property owner's expense, if there is insufficient evidence of structural strength or integrity of the building or structure.

Exception: In lieu of compliance with the seismic provisions of Sections R403.1.6, R602.10 and R602.11, if *approved* by the *building official*, the applicant may evaluate and strengthen portions of the building lateral support structure, such as foundations and cripple walls.

Note: Where applicable, the submittal of City of Seattle Earthquake Home Retrofit Plans may be used to demonstrate compliance with the exception to Section R107.5.1.2. See www.seattle.gov/sdci/permits/permits-we-issue-(a-z)/earthquake-home-retrofit-permit#2.startpermitapplication for more information.

R107.5.1.3 Other structural work. All other structural work shall comply with the requirements of Chapters 3, 4, 5, 6, 8 and 10 of this code.

R107.5.2 Landmarks—Historic buildings and structures. The *building official* may modify the specific requirements of this code as it applies to landmarks, and require in lieu thereof alternate requirements that will result in a reasonable degree of safety to the public and the occupants of those buildings. **

Exception: *Repair* of buildings with *damage ratios* of 60 percent or more shall comply with Section R107.5.1.

R107.5.3 Unreinforced masonry chimneys. If an unreinforced *masonry chimney* is altered or if the building in which such a chimney is located undergoes substantial *alteration* as defined in Section R107.5.1, the chimney shall be altered to conform to rules promulgated by the *building official*. **

R107.5.4 Compliance with retroactive ordinances. *Alterations* and repairs to existing buildings that are being made in response to a notice or order requiring compliance with the *Housing and Building Maintenance Code*, Subtitle II, Title 22 of the *Seattle Municipal Code*, the *Fire Code*, Subtitle VI, Title 22 of the *Seattle Municipal Code*, or other ordinances applicable to existing buildings, shall be permitted to be made in accordance with the standards contained in those ordinances rather than the standards for new buildings contained in this code. If standards are not specified in those ordinances, such *alterations* or repairs shall conform to the requirements of this chapter and Chapter 44.

R107.5.5 Nonstructural alterations. *Alterations* that are nonstructural and that do not affect any member or part of the building or structure required to be fire resistant may be made with the same materials of which the building or structure is constructed, provided that no change is permitted that increases its hazard.

R107.5.6 Maintenance of structural stability. If approved by the building official, minor structural alterations necessary to maintain the structural stability of the building may be made with the same material of which the building or structure is constructed.

R107.5.7 Unsafe building appendages. Parapet walls, cornices, chimneys and other appendages or structural members that are supported by, attached to, or a part of a building and that are in a deteriorated condition or are otherwise unable to sustain the design loads specified in this code, are hereby designated as unsafe building appendages. All such unsafe building appendages are public nuisances and shall be abated in accordance with Section R102. **

R107.5.8 Change of use. If the use of a building or portion thereof is changed, any elements of the *dwelling unit* envelope that are altered shall comply with the sound transmission control requirements of Section R336. If the use of a building or portion thereof is changed to *adult family home* or to *family home child care*, the building shall comply with the applicable provisions of Section R330 or R331.

R107.6 Rat abatement for demolished buildings. All applicants for a demolition permit shall initiate a rat abatement program on the project site at least 15 days prior to the start of demolition or any clearing or grading activity on the demolition site.

Exception: Subject to approval of the *building official*, the requirements of the rat eradication program may be reduced or waived for projects which an emergency order or hazard correction order has been issued pursuant to Section R102.

R107.6.1 Duration of rat abatement program. The rat abatement program must continue at least until demolition begins. No demolition or clearing or grading on the demolition site shall begin until the rat abatement program is complete unless approved by the *building official*. The rat abatement program may be terminated or waived by the building official when supported by a written recommendation of a licensed pest control agent.

R107.6.2 Requirements of rat abatement program. The rat abatement program shall be approved by a qualified pest control agent and shall comply with the Seattle-King County Public Health Department guidelines and recommendations for rat baiting. The use of any pesticide shall comply with WAC 16-228-1380. The *building official* may require additional deterrent measures on recommendation of the Seattle-King County Public Health Department.

R107.6.3 Demolition permit. The *building official* shall not issue any demolition permit until the applicant has provided a copy of the rat abatement program and a declaration that the requirements of Section R107.6 have been or will be complied with prior to the start of demolition.

SECTION R108
FEES

R108.1 Fees. A fee for each permit and for other activities related to the enforcement of this code shall be paid as set forth in the Fee Subtitle.

SECTION R109
INTERPRETATION

R109.1 Defined terms. Selected words and terms defined in Chapter 2 are italicized where they appear in code text. Defined terms added or amended by The City of Seattle may also appear in italics. When defined terms are not italicized, consider the context to judge applicability of the definition in Chapter 2.

Part II—Definitions

CHAPTER 2
DEFINITIONS

User notes:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.*

Code development reminder: *Code change proposals to definitions in this chapter preceded by a bracketed letter are considered by the IRC—Building Code Development Committee [RB], the IRC—Mechanical/Plumbing Code Development Committee [MP] or the IECC—Residential Code Development Committee [RE] during the Group B (2022) Code Development Cycle.*

SECTION R201
GENERAL

R201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

R201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

R201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have the meanings ascribed in other code publications of the International Code Council.

R201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

[S] R201.5 References to other codes. Whenever an International, National or Uniform Code is referenced in this code, it shall mean the Seattle edition of that code, including any local amendments. References to the "Building Code," "Fire Code," "Mechanical Code" and "Plumbing Code" mean the Seattle editions of those codes.

SECTION R202
DEFINITIONS

[S][RE] ABOVE-GRADE WALL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ACCESS (TO). That which enables a device, an *appliance* or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel, door or similar obstruction.

[S][RE] ACCESSIBLE. For the definition applicable to the *Seattle Residential Energy Code*, see Section R202 in the residential section of the *Seattle Energy Code*.

[RB] ACCESSORY STRUCTURE. A structure that is accessory to and incidental to that of the *dwelling(s)* and that is located on the same *lot*.

[S][RB] ADDITION. An extension or increase in floor area, number of stories or height of a building or structure. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ADHERED STONE OR MASONRY VENEER. Stone or masonry veneer secured and supported through the adhesion of an *approved* bonding material applied to an *approved* backing.

[W] ADULT FAMILY HOME. A *dwelling*, licensed by the State of Washington Department of Social and Health Services, in which a person or persons provide personal care, special care, room and board to more than one but not more than six adults who are not related by blood or marriage to the person or persons providing the services. An existing adult family home may provide services to up to eight adults upon approval from the Department of Social and Health Services in accordance with RCW 70.128.066.

DEFINITIONS

[MP] AIR ADMITTANCE VALVE. A one-way valve designed to allow air into the plumbing drainage system where a negative pressure develops in the piping. This device shall close by gravity and seal the terminal under conditions of zero differential pressure (no flow conditions) and under positive internal pressure.

[S][RE] AIR BARRIER. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] AIR BREAK (DRAINAGE SYSTEM). An arrangement where a discharge pipe from a fixture, *appliance* or device drains indirectly into a receptor below the flood-level rim of the receptor and above the trap seal.

[MP] AIR CIRCULATION, FORCED. A means of providing space conditioning utilizing movement of air through ducts or plenums by mechanical means.

[MP] AIR GAP, DRAINAGE SYSTEM. The unobstructed vertical distance through free atmosphere between the outlet of a waste pipe and the flood-level rim of the fixture or receptor into which it is discharging.

[MP] AIR GAP, WATER-DISTRIBUTION SYSTEM. The unobstructed vertical distance through free atmosphere between the lowest opening from a water supply discharge to the flood-level rim of a plumbing fixture.

[MP] AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return-air systems, and shall include any apparatus installed in connection therewith.

[S][RB] AIR-IMPERMEABLE INSULATION. An insulation having an air permanence equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential as tested in accordance with ASTM E283 or E2178. For the definition applicable to the *Seattle Residential Energy Code*, see Section R202 in the residential section of the *Seattle Energy Code*.

[S][RB] ALTERATION. Any construction, retrofit or renovation to an existing structure other than *repair* or *addition* that requires a *permit*. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, *addition* or change to the arrangement, type or purpose of the original installation that requires a *permit*. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

[RB] ANCHORED STONE OR MASONRY VENEER. Stone or masonry veneer secured with *approved* mechanical fasteners to an *approved* backing.

[MP] ANCHORS. See "*Supports*."

[MP] ANTISIPHON. A term applied to valves or mechanical devices that eliminate siphonage.

[MP] APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

[RB] APPROVED. Acceptable to the *building official*.

[S][RB] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification, and has been *approved* by the building official. For the definition applicable to the Seattle Residential Energy Code, see Section R202 in the residential section of the Seattle Energy Code.

[MP] APPROVED SOURCE. An independent person, firm or corporation, *approved* by the *building official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

[RB] ASPECT RATIO. The ratio of longest to shortest perpendicular dimensions, or for wall sections, the ratio of height to length.

[RB] ATTIC. The unfinished space between the ceiling assembly and the *roof assembly*.

[RB] ATTIC, HABITABLE. A finished or unfinished *habitable space* within an attic.

Interpretation: This definition does not include dormers, but may include gable ends. Knee walls are inside the structural envelope.

[S][RE] AUTOMATIC. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] BACKFLOW, DRAINAGE. A reversal of flow in the drainage system.

[MP] BACKFLOW, WATER DISTRIBUTION. The flow of water or other liquids into the potable water-supply piping from any sources other than its intended source. Back-siphonage is one type of backflow.

[MP] BACKFLOW PREVENTER. A backflow prevention assembly, a backflow prevention device or other means or method to prevent backflow into the potable water supply.

[MP] BACKFLOW PREVENTER, REDUCED-PRESSURE-ZONE TYPE. A backflow-prevention device consisting of two independently acting check valves, internally force loaded to a normally closed position and separated by an intermediate chamber (or zone) in which there is an automatic relief means of venting to atmosphere internally loaded to a normally open position between two tightly closing shutoff valves and with means for testing for tightness of the checks and opening of relief means.

[MP] BACKPRESSURE. Pressure created by any means in the water distribution system that by being in excess of the pressure in the water supply mains causes a potential backflow condition.

[MP] BACKPRESSURE, LOW HEAD. A pressure less than or equal to 4.33 psi (29.88 kPa) or the pressure exerted by a 10-foot (3048 mm) column of water.

[MP] BACKSIPHONAGE. The flowing back of used or contaminated water from piping into a potable water-supply pipe due to a negative pressure in such pipe.

[MP] BACKWATER VALVE. A device installed in a drain or pipe to prevent backflow of sewage.

[MP] BALANCED VENTILATION. Any combination of concurrently operating mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10 percent of the total mechanical supply airflow rate.

[MP] BALANCED VENTILATION SYSTEM. A ventilation system where the total supply airflow and total exhaust airflow are simultaneously within 10 percent of their averages. The balanced ventilation system airflow is the average of the supply and exhaust airflows.

[RB] BASEMENT. A *story* that is not a *story above grade plane* (see "*Story above grade plane*").

[S][RE] BASEMENT WALL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section R301.2.1) as given in Figure R301.2(5)A.

[MP] BATHROOM GROUP. A group of fixtures, including or excluding a bidet, consisting of a water closet, lavatory, and bathtub or shower. Such fixtures are located together on the same floor level.

[MP] BEND. A drainage fitting, designed to provide a change in direction of a drain pipe of less than the angle specified by the amount necessary to establish the desired slope of the line (see "*Elbow*" and "*Sweep*").

[S][MP] BOILER. ((~~A self-contained *appliance* from which hot water is circulated for heating purposes and then returned to the boiler, and that operates at water pressures not exceeding 160 pounds per square inch gage (psig) (1102 kPa gauge) and at water temperatures not exceeding 250°F (121°C).~~)) A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the direct application of heat. The term "boiler" shall also include fired units for heating or vaporizing liquids other than water where these systems are complete within themselves.

[RB] BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

[RB] BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

[RB] BRACED WALL LINE, CONTINUOUSLY SHEATHED. A *braced wall line* with structural sheathing applied to all sheathable surfaces including the areas above and below openings.

[RB] BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel's length meets the requirements of its particular bracing method, and contributes toward the total amount of bracing required along its *braced wall line* in accordance with Section R602.10.1.

[MP] BRANCH. Any part of the piping system other than a riser, main or stack.

[MP] BRANCH, FIXTURE. See "*Fixture branch, drainage*."

[MP] BRANCH, HORIZONTAL. See "*Horizontal branch, drainage*."

[MP] BRANCH, MAIN. A water-distribution pipe that extends horizontally off a main or riser to convey water to branches or fixture groups.

[MP] BRANCH, VENT. A vent connecting two or more individual vents with a vent stack or stack vent.

[MP] BRANCH INTERVAL. A vertical measurement of distance, 8 feet (2438 mm) or more in *developed length*, between the connections of *horizontal* branches to a drainage stack. Measurements are taken down the stack from the highest *horizontal* branch connection.

[MP] BTU/H. The *listed* maximum capacity of an *appliance*, absorption unit or burner expressed in British thermal units input per hour.

DEFINITIONS

[W][S][RB] BUILDING. Any one- or two-family dwelling or *townhouse*, or portion thereof, used or intended to be used for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, or any *accessory structure*. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[W][RB] BUILDING, EXISTING. ((~~Existing building is a~~)) A building or structure erected prior to the adoption of this code, or one ((~~for which a legal building *permit* has been issued~~)) that has passed a final inspection.

[MP] BUILDING DRAIN. The lowest piping that collects the discharge from all other drainage piping inside the house and extends 30 inches (762 mm) in *developed length* of pipe, beyond the exterior walls and conveys the drainage to the *building sewer*.

[RB] BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[S][RB] BUILDING OFFICIAL. The ((~~officer or other designated authority charged with the administration and enforcement of this code~~)) Director of the Seattle Department of Construction and Inspections, or a duly authorized representative. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] BUILDING SEWER. That part of the drainage system that extends from the end of the *building drain* and conveys its discharge to a public sewer, private sewer, individual sewage-disposal system or other point of disposal.

[S][RE] BUILDING SITE. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] BUILDING THERMAL ENVELOPE. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] BUILDING-INTEGRATED PHOTOVOLTAIC PRODUCT. A building product that incorporates *photovoltaic modules* and functions as a component of the building envelope.

[RB] BUILDING-INTEGRATED PHOTOVOLTAIC ROOF PANEL (BIPV Roof Panel). A *photovoltaic panel* that functions as a component of the building envelope.

[RB] BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

[RB] CAP PLATE. The top plate of the double top plates used in *structural insulated panel* (SIP) construction. The cap plate is cut to match the *panel thickness* such that it overlaps the wood structural panel facing on both sides.

[RB] CARBON MONOXIDE ALARM. A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

[RB] CARBON MONOXIDE DETECTOR. A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

[RB] CEILING HEIGHT. The clear vertical distance from the finished floor to the finished ceiling.

[RB] CEMENT PLASTER. A mixture of Portland or blended cement, Portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other *approved* materials as specified in this code.

[RB] CHANGE OF OCCUPANCY. A change in the use of a building or portion of a building that involves a change in the application of the requirements of this code.

[W] CHILD CARE, FAMILY HOME. A child care facility, licensed by Washington State, located in the dwelling of the person or persons under whose direct care and supervision the child is placed, for the care of 16 or fewer children, including children who reside at the home.

[W] CHILD DAY CARE. Shall, for the purposes of these regulations, mean the care of children during any period of a 24-hour day.

[MP] CHIMNEY. A primary vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning *appliance* to the outside atmosphere.

[MP] CHIMNEY CONNECTOR. A pipe that connects a fuel-burning *appliance* to a chimney.

[MP] CHIMNEY TYPES.

Residential-type appliance. An *approved* chimney for removing the products of combustion from fuel-burning, residential-type *appliances* producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, and capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to 1 hour. All temperatures shall be measured at the *appliance* flue outlet. Residential-type *appliance* chimneys include masonry and factory-built types.

[MP] CIRCUIT VENT. A vent that connects to a horizontal drainage branch and vents two traps to not more than eight traps or trapped fixtures connected into a battery.

[S][MP] CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] CLADDING. The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

[MP] CLEANOUT. An access opening in the drainage system utilized for the removal of obstructions. Types of cleanouts include a removable plug or cap, and a removable fixture or fixture trap.

[S][RE] CLIMATE ZONE. A geographical region based on climatic criteria as specified in this code. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] CLOSET. A small room or chamber used for storage.

[RB] COLLAPSIBLE SOILS. Soils that exhibit volumetric reduction in response to partial or full wetting under load.

[MP] COLLECTION PIPE. Unpressurized pipe used within the collection system that drains on-site nonpotable water or rainwater to a storage tank by gravity.

[MP] COMBINATION WASTE AND VENT SYSTEM. A specially designed system of waste piping embodying the horizontal wet venting of one or more sinks, lavatories or floor drains by means of a common waste and vent pipe adequately sized to provide free movement of air above the flow line of the drain.

[RB] COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

[MP] COMBUSTION AIR. The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and *ventilation* of the equipment enclosure.

[MP] COMMON VENT. A single pipe venting two trap arms within the same *branch interval*, either back-to-back or one above the other.

[RB] COMPRESSIBLE SOILS. Soils that exhibit volumetric reduction in response to the application of load even in the absence of wetting or drying.

[MP] CONDENSATE. The liquid that separates from a gas due to a reduction in temperature; for example, water that condenses from flue gases and water that condenses from air circulating through the cooling coil in air conditioning equipment.

[MP] CONDENSING APPLIANCE. An *appliance* that condenses water generated by the burning of fuels.

[RB] CONDITIONED AIR. Air treated to control its temperature, relative humidity or quality.

[S][RE] CONDITIONED FLOOR AREA. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[W][S][RE] CONDITIONED SPACE. ((~~For the definition applicable in Chapter 11, see Section N1101.6.~~)) An area, room or space that is enclosed within the *building thermal envelope* and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with *conditioned spaces*, where they are separated from *conditioned spaces* by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, *piping* or other sources of heating or cooling. For the definition applicable to the *Seattle Residential Energy Code*, see Section R202 in the residential section of the *Seattle Energy Code*.

[RB] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building *permit*. Construction drawings shall be drawn to an appropriate scale.

[MP] CONTAMINATION. A high-hazard or health-hazard impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids or waste.

[S][RE] CONTINUOUS AIR BARRIER. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] CONTINUOUS INSULATION (ci). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] CONTINUOUS WASTE. A drain from two or more similar adjacent fixtures connected to a single trap.

[MP] CONTROL, LIMIT. An automatic control responsive to changes in liquid flow or level, pressure, or temperature for limiting the operation of an *appliance*.

[MP] CONTROL, PRIMARY SAFETY. A safety control responsive directly to flame properties that senses the presence or absence of flame and, in event of ignition failure or unintentional flame extinguishment, automatically causes shutdown of mechanical equipment.

[MP] CONVECTOR. A system incorporating a heating element in an enclosure in which air enters an opening below the heating element, is heated and leaves the enclosure through an opening located above the heating element.

[RB] CORE. The lightweight middle section of a *structural insulated panel*, composed of foam plastic insulation, that provides the link between the two facing shells.

[RB] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties where exposed to its environment.

[RB] COURT. A space, open and unobstructed to the sky, located at or above *grade* level on a *lot* and bounded on three or more sides by walls or a building.

[RB] CRAWL SPACE. An underfloor space that is not a *basement*.

[S][RE] CRAWL SPACE WALL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first *story above grade plane*.

[RB] CRIPPLE WALL CLEAR HEIGHT. The vertical height of a *cripple wall* from the top of the foundation to the underside of floor framing above.

[MP] CROSS CONNECTION. Any connection between two otherwise separate piping systems that allows a flow from one system to the other.

[RB] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

[S][RE] CURTAIN WALL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

[S] DAMAGE RATIO. The ratio between the cost of work and the estimated replacement cost of the building, expressed as a percentage. The work includes repair of damage to structural and fire/life safety systems.

[MP] DAMPER, VOLUME. A device that will restrict, retard or direct the flow of air in any duct, or the products of combustion of heat-producing equipment, vent connector, vent or chimney.

[RB] DEAD LOADS. The weight of the materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, *stairways*, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment.

[RB] DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material with a purpose that is decorative or artistic, not functional; with coloring, texture or other design qualities or components that cannot be removed without destroying the glazing material; and with a surface, or assembly into which it is incorporated, that is divided into segments.

[S][RE] DEMAND RECIRCULATION WATER SYSTEM. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] DESIGN PROFESSIONAL. See "*Registered design professional*."

[MP] DEVELOPED LENGTH. The length of a pipeline measured along the center line of the pipe and fittings.

[MP] DIAMETER. Unless specifically stated, the term "diameter" is the nominal diameter as designated by the *approved* material standard.

[RB] DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. Where the term "*diaphragm*" is used, it includes horizontal bracing systems.

[MP] DILUTION AIR. Air that enters a draft hood or draft regulator and mixes with flue gases.

[MP] DIRECT SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop is not separated from the load.

[MP] DIRECT-VENT APPLIANCE. A fuel-burning *appliance* with a sealed combustion system that draws all air for combustion from the outside atmosphere and discharges all flue gases to the outside atmosphere.

[W] DISTRIBUTED WHOLE HOUSE VENTILATION. A whole house ventilation system shall be considered distributed when it supplies outdoor air directly (not transfer air) to each dwelling or sleeping unit habitable space (living room, den, office, interior adjoining spaces or bedroom), and exhausts air from all kitchens and bathrooms directly outside.

[MP] DRAFT. The pressure difference existing between the *appliance* or any component part and the atmosphere, that causes a continuous flow of air and products of combustion through the gas passages of the *appliance* to the atmosphere.

Induced draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the *appliance* and the chimney or vent termination.

Natural draft. The pressure difference created by a vent or chimney because of its height, and the temperature difference between the flue gases and the atmosphere.

[MP] DRAFT HOOD. A device built into an *appliance*, or a part of the vent connector from an *appliance*, that is designed to provide for the ready escape of the flue gases from the *appliance* in the event of no draft, backdraft or stoppage beyond the draft hood; prevent a backdraft from entering the *appliance*; and neutralize the effect of stack action of the chimney or gas vent on the operation of the *appliance*.

[MP] DRAFT REGULATOR. A device that functions to maintain a desired draft in the *appliance* by automatically reducing the draft to the desired value.

[RB] DRAFT STOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and *attics*.

[MP] DRAIN. Any pipe that carries soil and waterborne wastes in a building drainage system.

[MP] DRAINAGE FITTING. A pipe fitting designed to provide connections in the drainage system that have provisions for establishing the desired slope in the system. These fittings are made from a variety of both metals and plastics. The methods of coupling provide for required slope in the system.

[MP] DRAIN-BACK SYSTEM. A solar thermal system in which the fluid in the solar collector loop is drained from the collector into a holding tank under prescribed circumstances.

[S][RE] DUCT. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][MP] DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling *equipment* and *appliances*.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] DWELLING. Any building that contains one or two *dwelling units* used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

[W][S][RB] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. Dwelling units may also include the following uses:

1. *Adult family homes*, foster family care homes and family day care homes licensed by the Washington State Department of Social and Health Services.
2. Offices, mercantile, food preparation for off-site consumption, personal care salons or similar uses which are conducted primarily by the occupants of the dwelling unit and are secondary to the use of the unit for dwelling purposes, and which do not exceed 500 square feet (46.4 m^2). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] DWV. Abbreviated term for drain, waste and vent piping as used in common plumbing practice.

[MP] EFFECTIVE OPENING. The minimum cross-sectional area at the point of water-supply discharge, measured or expressed in terms of diameter of a circle and if the opening is not circular, the diameter of a circle of equivalent cross-sectional area. (This is applicable to *air gap*.)

[W] EGRESS ROOF ACCESS WINDOW. A skylight or roof window designed and installed to satisfy the *emergency escape and rescue opening* requirements of Section R310.2.

[MP] ELBOW. A pressure pipe fitting designed to provide an exact change in direction of a pipe run. An elbow provides a sharp turn in the flow path (see "Bend" and "Sweep").

[RB] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency. (See also "*Grade floor emergency escape and rescue opening*.")

[W] ENCLOSED KITCHEN. A kitchen whose permanent openings to interior adjacent spaces do not exceed a total of 60 square feet (6 m^2).

[S][RE] ENERGY ANALYSIS. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] ENERGY COST. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] ENERGY SIMULATION TOOL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ENERGY STORAGE SYSTEMS (ESS). One device or multiple devices, assembled together, capable of storing electrical energy to be supplied at a future time.

[RB] ENGINEERED WOOD RIM BOARD. A full-depth *structural composite lumber*, wood structural panel, structural glued laminated timber or prefabricated wood I-joist member designed to transfer horizontal (shear) and vertical (compression) loads, provide attachment for *diaphragm* sheathing, siding and exterior deck ledgers and provide lateral support at the ends of floor or roof joists or rafters.

[MP] EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than *appliances* that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

[MP] EQUIVALENT LENGTH. For determining friction losses in a piping system, the effect of a particular fitting equal to the friction loss through a straight piping length of the same nominal diameter.

[S][RE] ERI REFERENCE DESIGN. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ESCARPMENT. With respect to topographic wind effects, a cliff or steep slope generally separating two levels or gently sloping areas.

[MP] ESSENTIALLY NONTOXIC TRANSFER FLUIDS. Fluids having a Gosselin rating of 1, including propylene glycol; mineral oil; polydimethy oil oxane; hydrochlorofluorocarbon, chlorofluorocarbon and hydrofluorocarbon refrigerants; and FDA-approved boiler water additives for steam boilers.

[MP] ESSENTIALLY TOXIC TRANSFER FLUIDS. Soil, water or graywater and fluids having a Gosselin rating of 2 or more including ethylene glycol, hydrocarbon oils, ammonia refrigerants and hydrazine.

[MP] EVAPORATIVE COOLER. A device used for reducing air temperature by the process of evaporating water into an airstream.

[MP] EXCESS AIR. Air that passes through the combustion chamber and the *appliance* flue in excess of what is theoretically required for complete combustion.

[MP] EXHAUST HOOD, FULL OPENING. An exhaust hood with an opening not less than the diameter of the connecting vent.

[MP] EXISTING INSTALLATIONS. Any plumbing system regulated by this code that was legally installed prior to the effective date of this code, or for which a *permit* to install has been issued.

[RB] EXPANSIVE SOILS. Soils that exhibit volumetric increase or decrease (swelling or shrinking) in response to partial or full wetting or drying under load.

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS). EIFS are nonstructural, nonload-bearing exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE. An EIFS that incorporates a means of drainage applied over a *water-resistive barrier*.

[S][RB] EXTERIOR WALL. An above-*grade* wall that defines the exterior boundaries of a building. Includes between-floor spandrels, peripheral edges of floors, roof and *basement* knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and *basement walls* with an average below-*grade* wall area that is less than 50 percent of the total opaque and nonopaque area of that enclosing side.

For the definition applicable in ((~~Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resistive barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural *trim* and embellishments such as cornices, soffits, and fascias.

[RB] FACING. The wood structural panel facings that form the two outmost rigid layers of the *structural insulated panel*.

[MP] FACTORY-BUILT CHIMNEY. A *listed* and *labeled* chimney composed of factory-made components assembled in the field in accordance with the manufacturer's instructions and the conditions of the *listing*.

[MP] FACTORY-MADE AIR DUCT. A *listed and labeled* duct manufactured in a factory and assembled in the field in accordance with the manufacturer's instructions and conditions of the *listing*.

[S][RE] FENESTRATION. Products classified as either vertical fenestration or *skylights and sloped glazing*, installed in such a manner as to preserve the weather-resistant barrier of the wall or roof in which they are installed. Fenestration includes products with glass or other transparent or translucent materials.

For the definition applicable in ((~~Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

Skylights. For the definition applicable to the *Seattle Residential Energy Code*, see Section R202 in the residential section of the *Seattle Energy Code*.

Vertical fenestration. See "*Fenestration, vertical*."

[S][RE] FENESTRATION, VERTICAL. Windows that are fixed or movable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors installed in a wall at less than 15 degrees (0.26 rad) from vertical.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] FENESTRATION PRODUCT, SITE-BUILT. For the definition applicable in ((~~Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] FIBER-CEMENT (BACKERBOARD, SIDING, SOFFIT, TRIM AND UNDERLAYMENT) PRODUCTS. Manufactured thin section composites of hydraulic cementitious matrices and discrete nonasbestos fibers.

[W][S][RB] FIRE SEPARATION DISTANCE. The distance measured from the ((~~building~~)) foundation wall or face of the wall framing, whichever is closer, to one of the following:

1. To the closest interior *lot line*; or ((~~.~~))
2. To the ((~~centerline~~)) opposite side of a street, an alley or public way; or ((~~.~~))
3. To an imaginary line between two buildings on the *lot*.

The distance shall be measured at a right angle from ((~~the face of~~)) the wall.

[RB] FIREBLOCKING. Building materials or materials *approved* for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

[RB] FIREPLACE. An assembly consisting of a hearth and fire chamber of *noncombustible material* and provided with a chimney, for use with solid fuels.

[MP] FIREPLACE STOVE. A free-standing, chimney-connected solid-fuel-burning heater designed to be operated with the fire chamber doors in either the open or closed position.

[RB] FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

[RB] FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface burning characteristics and resist propagation of fire.

Other means during manufacture. A process where the wood raw material is treated with a fire-retardant formulation while undergoing creation as a finished product.

Pressure process. A process for treating wood using an initial vacuum followed by the introduction of pressure above atmospheric.

[MP] FIXTURE. See "*Plumbing fixture*."

[MP] FIXTURE BRANCH, DRAINAGE. A drain serving two or more fixtures that discharges into another portion of the drainage system.

[MP] FIXTURE BRANCH, WATER-SUPPLY. A water-supply pipe between the fixture supply and a main water-distribution pipe or fixture group main.

[MP] FIXTURE DRAIN. The drain from the trap of a fixture to the junction of that drain with any other drain pipe.

[MP] FIXTURE FITTING.

Supply fitting. A fitting that controls the volume or directional flow or both of water and that is either attached to or accessed from a fixture or is used with an open or atmospheric discharge.

Waste fitting. A combination of components that conveys the sanitary waste from the outlet of a fixture to the connection of the sanitary drainage system.

[MP] FIXTURE GROUP, MAIN. The main water-distribution pipe (or secondary branch) serving a plumbing fixture grouping such as a bath, kitchen or laundry area to which two or more individual fixture branch pipes are connected.

[MP] FIXTURE SUPPLY. The water-supply pipe connecting a fixture or fixture fitting to a fixture branch.

[MP] FIXTURE UNIT, DRAINAGE (d.f.u.). A measure of probable discharge into the drainage system by various types of plumbing fixtures, used to size DWV piping systems. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

[MP] FIXTURE UNIT, WATER-SUPPLY (w.s.f.u.). A measure of the probable hydraulic demand on the water supply by various types of plumbing fixtures used to size water-piping systems. The water-supply fixture-unit value for a particular fixture depends on its volume rate of supply, on the time duration of a single supply operation and on the average time between successive operations.

[RB] FLAME SPREAD. The propagation of flame over a surface.

[RB] FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.

[MP] FLEXIBLE AIR CONNECTOR. A conduit for transferring air between an air duct or plenum and an air terminal unit, an air inlet or an air outlet. Such conduit is limited in its use, length and location.

[RB] FLIGHT. A continuous run of rectangular treads or *winders* or combination thereof from one landing to another.

[S] FLOATING HOME. A single-family dwelling constructed to float, which is moored, anchored or otherwise secured in waters. A floating home is not a vessel, even though it may be capable of being towed, and is not a "floating on water residence" as defined in the *Seattle Municipal Code* Title 23.

[S] FLOATING HOME MOORAGE. A waterfront facility for the moorage of one or more *floating homes* and the land and water premises on which it is located.

[S] FLOATING HOME SITE. A part of a *floating home moorage*, located over water, and designed to accommodate one *floating home*.

[MP] FLOOD-LEVEL RIM. The edge of the receptor or fixture from which water overflows.

[W] FLOOR AREA. The area within the inside perimeter of exterior walls of the building. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

[MP] FLOOR DRAIN. A plumbing fixture for recess in the floor having a floor-level strainer intended for the purpose of the collection and disposal of wastewater used in cleaning the floor and for the collection and disposal of accidental spillage to the floor.

[MP] FLOOR FURNACE. A self-contained furnace suspended from the floor of the space being heated, taking air for combustion from outside such space, and with means for lighting the *appliance* from such space.

[MP] FLOW PRESSURE. The static pressure reading in the water-supply pipe near the faucet or water outlet while the faucet or water outlet is open and flowing at capacity.

[MP] FLUE. See "*Vent*."

[MP] FLUE, APPLIANCE. The passages within an *appliance* through which combustion products pass from the combustion chamber to the flue collar.

[MP] FLUE COLLAR. The portion of a fuel-burning *appliance* designed for the attachment of a draft hood, vent connector or venting system.

[MP] FLUE GASES. Products of combustion plus excess air in *appliance* flues or heat exchangers.

[MP] FLUSH VALVE. A device located at the bottom of a flush tank that is operated to flush water closets.

[MP] FLUSHOMETER TANK. A device integrated within an air accumulator vessel that is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

[MP] FLUSHOMETER VALVE. A flushometer valve is a device that discharges a predetermined quantity of water to fixtures for flushing purposes and is actuated by direct water pressure.

[RB] FOAM BACKER BOARD. Foam plastic used in siding applications where the foam plastic is a component of the siding.

[RB] FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustic purposes and that has a density less than 20 pounds per cubic foot (320 kg/m^3) unless it is used as interior *trim*.

[RB] FOAM PLASTIC INTERIOR TRIM. Exposed foam plastic used as picture molds, chair rails, crown moldings, baseboards, *handrails*, ceiling beams, door *trim* and window *trim* and similar decorative or protective materials used in fixed applications.

[RB] FUEL CELL POWER SYSTEM, STATIONARY. A stationary energy generation system that converts the chemical energy of a fuel and oxidant to electric energy (DC or AC electricity) by an electrochemical process.

Field-fabricated fuel cell power system. A *stationary fuel cell power system* that is assembled at the job site and is not a preengineered or prepackaged factory-assembled fuel cell power system.

Preengineered fuel cell power system. A *stationary fuel cell power system* consisting of components and modules that are produced in a factory, and shipped to the job site for assembly.

Prepackaged fuel cell power system. A *stationary fuel cell power system* that is factory assembled as a single, complete unit and shipped as a complete unit for installation at the job site.

[MP] FUEL-PIPING SYSTEM. All piping, tubing, valves and fittings used to connect fuel utilization equipment to the point of fuel delivery.

[MP] FULL-OPEN VALVE. A water control or shutoff component in the water supply system piping that, where adjusted for maximum flow, the flow path through the component's closure member is not a restriction in the component's through-flow area.

[MP] FULLWAY VALVE. A valve that in the full open position has an opening cross-sectional area that is not less than 85 percent of the cross-sectional area of the connecting pipe.

[MP] FURNACE. A vented heating *appliance* designed or arranged to discharge heated air into a *conditioned space* or through a duct or ducts.

[S] GARBAGE. All discarded putrescible waste matter, including small dead animals weighing not over 15 pounds (6.8 kg), but not including sewage or human or animal excrement.

[RB] GLASS MAT GYPSUM PANEL. A gypsum panel consisting of a noncombustible core primarily of gypsum, surfaced with glass mat partially or completely embedded in the core.

[RB] GLAZING AREA. The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose *conditioned space*. Includes the area of glazed fenestration assemblies in walls bounding conditioned *basements*.

[RB] GRADE. The finished ground level adjoining the building at all exterior walls.

[MP] GRADE, PIPING. See "*Slope*."

[RB] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An emergency escape and rescue opening located such that the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also "*Emergency escape and rescue opening*.")

[RB] GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building between the structure and a point 6 feet (1829 mm) from the building.

[MP] GRAYWATER. Waste discharged from lavatories, bathtubs, showers, clothes washers and laundry trays.

[MP] GRIDDED WATER DISTRIBUTION SYSTEM. A water distribution system where every water distribution pipe is interconnected so as to provide two or more paths to each fixture supply pipe.

[RB] GROSS AREA OF EXTERIOR WALLS. The normal projection of all *exterior walls*, including the area of all windows and doors installed therein.

[MP] GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

[RB] GUARD. A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

[RB] GUESTROOM. Any room or rooms used or intended to be used by one or more guests for living or sleeping purposes.

[RB] GYPSUM BOARD. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum *veneer* plaster, exterior gypsum soffit board, predecorated gypsum board and water-resistant gypsum backing board complying with the standards listed in Section R702.3 and Part IX of this code are types of gypsum board.

[RB] GYPSUM PANEL PRODUCT. The general name for a family of sheet products consisting essentially of gypsum.

[RB] GYPSUM SHEATHING. Gypsum panel products specifically manufactured with enhanced water resistance for use as a substrate for exterior surface materials.

[RB] GYPSUM WALLBOARD. A gypsum board used primarily as interior surfacing for building structures.

[RB] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered *habitable spaces*.

[RB] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

[MP] HANGERS. See "*Supports*."

[MP] HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances.

[MP] HEAT PUMP. An *appliance* having heating or heating and cooling capability and that uses refrigerants to extract heat from air, liquid or other sources.

[S][RE] HEATED SLAB. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] HEIGHT, BUILDING. The vertical distance from *grade plane* to the average height of the highest roof surface.

[RB] HEIGHT, STORY. The vertical distance from top to top of two successive tiers of beams or finished floor surfaces; and, for the topmost *story*, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

[RE] HIGH-EFFICACY LIGHT SOURCES. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] HIGH-TEMPERATURE (H.T.) CHIMNEY. A high-temperature chimney complying with the requirements of UL 103. A Type H.T. chimney is identifiable by the markings "Type H.T." on each chimney pipe section.

[RB] HILL. With respect to topographic wind effects, a land surface characterized by strong relief in any horizontal direction.

[S][RB] HISTORIC BUILDING. ((~~A building or structure that is one or more of the following:~~

1. ~~Listed, or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places in the National Register of Historic Places.~~
2. ~~Designated as historic under an applicable state or local law.~~
3. ~~Certified as a contributing resource within a National Register-listed, or a state-designated or locally designated historic district.~~

~~For the definition applicable in Chapter 11, see Section N1101.6.~~)) See "*Landmark*."

[MP] HORIZONTAL BRANCH, DRAINAGE. A drain pipe extending laterally from a soil or waste stack or *building drain*, that receives the discharge from one or more *fixture drains*.

[MP] HORIZONTAL PIPE. Any pipe or fitting that makes an angle of less than 45 degrees (0.79 rad) with the horizontal.

[MP] HOT WATER. Water at a temperature greater than 120ºF (49ºC).

[RB] HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes, defined as the US Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed, V_{ult}, is greater than 115 miles per hour (51 m/s), and Hawaii, Puerto Rico, Guam, Virgin Islands and America Samoa.

[MP] HYDROGEN-GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen-generating *appliances* utilize electrolysis, reformation, chemical or other processes to generate hydrogen.

[MP] IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include *appliance* burners, burner ignitions and electrical switching devices.

[RB] IMPACT PROTECTIVE SYSTEM. Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached, or locked over exterior glazing.

[MP] INDIRECT SYSTEM. A solar thermal system in which the gas or liquid in the solar collector loop circulates between the solar collector and a heat exchanger and such gas or liquid is not drained from the system or supplied to the load during normal operation.

[MP] INDIRECT WASTE PIPE. A waste pipe that discharges into the drainage system through an *air gap* into a trap, fixture or receptor.

[MP] INDIVIDUAL SEWAGE DISPOSAL SYSTEM. A system for disposal of sewage by means of a septic tank or mechanical treatment, designed for use apart from a public sewer to serve a single establishment or building.

[MP] INDIVIDUAL VENT. A pipe installed to vent a single *fixture drain* that connects with the vent system above or terminates independently outside the building.

[MP] INDIVIDUAL WATER SUPPLY. A supply other than an *approved* public water supply that serves one or more families.

[S][RE] INFILTRATION. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] INSULATED SIDING. A type of continuous insulation, with manufacturer-installed insulating material as an integral part of the cladding product, having a minimum *R*-value of R-2. For the definition applicable in Chapter 11, see Section N1101.6.

[RB] INSULATED VINYL SIDING. A vinyl cladding product, with manufacturer-installed foam plastic insulating material as an integral part of the cladding product, having a thermal resistance of not less than R-2.

[RB] INSULATING CONCRETE FORM (ICF). A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips, or other insulating material for constructing cast-in-place concrete walls.

[S][RB] INSULATING SHEATHING. A rigid panel or board insulation material having a thermal resistance of not less than R-2 of the core material with properties suitable for use on walls, floors, roofs or foundations.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

[S][RB] JURISDICTION. The ((~~governmental unit that has adopted this code~~)) City of Seattle.

[RB] KITCHEN. An area used, or designated to be used, for the preparation of food.

[RB] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an *approved agency* and that indicates that the representative sample of the product or material has been tested and evaluated by an *approved agency*. (See also "*Manufacturer's designation*" and "*Mark*.")

[S][RB] LABELED. Equipment, materials or products to which have been affixed a *label*, seal, symbol or other identifying *mark* of a nationally recognized testing laboratory, *approved* agency or other organization concerned with product evaluation that maintains periodic inspection of the production of such *labeled* items and whose labeling indicates either that the *equipment*, material or product meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S] LAND-DISTURBING ACTIVITY. Any activity that results in a movement of earth, or a change in the existing soil cover, both vegetative and nonvegetative, or the existing topography. Land-disturbing activities include, but are not limited to, clearing, grading, filling, excavation or addition of new or the replacement of impervious surface. Compaction, excluding hot asphalt mix, that is associated with stabilization of structures and road construction shall also be considered a land-disturbing activity. Vegetation maintenance practices are not considered land-disturbing activities.

[W] LANDING PLATFORM. A landing provided as the top step of a stairway accessing a *loft*.

[S] LANDMARK. A building or structure that is subject to a requirement to obtain a certificate of approval from the City Landmarks Preservation Board before altering or making significant changes to specific features or characteristics; that has been nominated for designation and the City Landmarks Preservation Board has not issued a determination regarding designation; that has been designated for preservation by the City Landmarks Preservation Board; that has been designated for preservation by the State of Washington; that has been listed or determined eligible to be listed in the National Register of Historic Places; or that is located in a landmark or special review district subject to a requirement to obtain a certificate of approval before making a change to the external appearance of a structure.

[RB] LIGHT-FRAME CONSTRUCTION. Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

[S][RB] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment*, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

[RB] LIVE/WORK UNIT. A *dwelling unit* or sleeping unit in which a significant portion of the space includes a non-residential use that is operated by the tenant.

[MP] LIVING SPACE. Space within a *dwelling unit* utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

[W][MP] LOCAL EXHAUST. An exhaust system that uses one or more fans to exhaust air from a specific room or rooms within a residential dwelling or sleeping unit.

[MP] LOCKING-TYPE TAMPER-RESISTANT CAP. A cap designed to be unlocked by a specially designed tool or key to prevent removal of the cap by means of hand-loosening or by commonly available tools.

[RB] LODGING HOUSE. A one-family dwelling where one or more occupants are primarily permanent in nature, and rent is paid for guestrooms.

[W] LOFT. A space on an intermediate level or levels between the floor and ceiling of a dwelling or sleeping unit, open on one or more sides to the room or space in which the loft is located, and in accordance with Section R333.

[RB] LOT. A measured portion or parcel of land considered as a unit having fixed boundaries.

[RB] LOT LINE. The line that bounds a plot of ground described as a lot in the title to the property.

[S][RE] LOW-VOLTAGE LIGHTING. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] MACERATING TOILET SYSTEMS. A system comprised of a sump with macerating pump and with connections for a water closet and other plumbing fixtures, that is designed to accept, grind and pump wastes to an *approved* point of discharge.

[MP] MAIN. The principal pipe artery to which branches may be connected.

[MP] MAIN SEWER. See "*Public sewer*."

[MP] MANIFOLD WATER DISTRIBUTION SYSTEMS. A fabricated piping arrangement in which a large supply main is fitted with multiple branches in close proximity in which water is distributed separately to fixtures from each branch.

[S][RE] MANUAL. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] MANUFACTURED HOME. A structure, transportable in one or more sections, that in the traveling mode is 8 body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length, or, where erected on site, is 320 square feet (30 m^2) or more, and that is built on a permanent chassis and designed to be used as a *dwelling* with or without a permanent foundation where connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein; except that such term shall include any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the secretary (HUD) and complies with the standards established under this title. For mobile homes built prior to June 15, 1976, a *label* certifying compliance to the Standard for Mobile Homes, NFPA 501, in effect at the time of manufacture is required. For the purpose of these provisions, a mobile home shall be considered to be a *manufactured home*.

[RB] MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also "*Mark*" and "*Label*.")

[RB] MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of their *listing* and *labeling*.

[RB] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "*Manufacturer's designation*" and "*Label*.")

[RB] MASONRY, SOLID. Masonry consisting of *solid masonry* units laid contiguously with the joints between the units filled with mortar.

[RB] MASONRY CHIMNEY. A field-constructed chimney composed of *solid masonry* units, bricks, stones or concrete.

Termite resistant. Alaska yellow cedar, redwood, Eastern red cedar and Western red cedar including all sapwood of Western red cedar.

[RB] NONCOMBUSTIBLE MATERIAL. A material that passes ASTM E136.

[RB] NOSING. The leading edge of treads of stairs and of landings at the top of *stairway* flights.

[RB] OCCUPIED SPACE. The total area of all buildings or structures on any *lot* or parcel of ground projected on a horizontal plane, excluding permitted projections as allowed by this code.

[MP] OFFSET. A combination of fittings that makes two changes in direction, bringing one section of the pipe out of line and into a line parallel with the other section.

[MP] ON-SITE NONPOTABLE WATER REUSE SYSTEMS. Water systems for the collection, treatment, storage, distribution, and reuse of nonpotable water generated on site, including but not limited to graywater systems. This definition does not include rainwater harvesting systems.

[S][RE] OPAQUE DOOR. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] OWNER. Any person, agent, firm or corporation having a legal or equitable interest in the property.

[RB] PAN FLASHING. Corrosion-resistant flashing at the base of an opening that is integrated into the building exterior wall to direct water to the exterior and is premanufactured, fabricated, formed or applied at the job site.

[RB] PANEL THICKNESS. Thickness of core plus two layers of structural wood panel facings.

[MP] PELLET FUEL-BURNING APPLIANCE. A closed combustion, vented *appliance* equipped with a fuel feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

[MP] PELLET VENT. A vent *listed* and *labeled* for use with a *listed* pellet fuel-burning *appliance*.

[RB] PERFORMANCE CATEGORY. A designation of wood structural panels as related to the panel performance used in Chapters 4, 5, 6 and 8.

[RB] PERMIT. An official document or certificate issued by the *building official* that authorizes performance of a specified activity.

[S][RB] PERSON. Any individual, ((~~heirs, executors, administrators or assigns, and a~~)) receiver, administrator, executor, trustee in bankruptcy, trust, estate firm, partnership, joint venture, club, company, joint stock company, business trust, municipal corporation, political subdivision of the State of Washington, the State of Washington and any instrumentality thereof, ((~~or~~)) corporation, ((~~its or their successors or assigns, or the agent of any of the aforesaid~~)) limited liability company, association, society or any group of individuals acting as a unit, whether mutual, cooperative, fraternal, nonprofit or otherwise, and the United States or any instrumentality thereof.

[RB] PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of a tracker, designed to generate DC power where exposed to sunlight.

[RB] PHOTOVOLTAIC PANEL. A collection of *photovoltaic modules* mechanically fastened together, wired, and designed to provide a field-installable unit.

[RB] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels that convert solar radiation into electricity, including rack support systems.

[RB] PHOTOVOLTAIC SHINGLES. A *roof covering* that resembles shingles and that incorporates *photovoltaic modules*.

[MP] PITCH. See "*Slope*."

[RB] PLASTIC COMPOSITE. A generic designation that refers to wood-plastic composites and plastic lumber.

[RB] PLATFORM CONSTRUCTION. A method of construction by which floor framing bears on load bearing walls that are not continuous through the *story* levels or floor framing.

[MP] PLENUM. A chamber that forms part of an air-circulation system other than the *occupied space* being conditioned.

[MP] PLUMBING. For the purpose of this code, plumbing refers to those installations, repairs, maintenance and *alterations* regulated by Chapters 25 through 33.

[MP] PLUMBING APPLIANCE. An energized household *appliance* with plumbing connections, such as a dishwasher, food waste disposer, clothes washer or water heater.

[MP] PLUMBING APPURTENANCE. A device or assembly that is an adjunct to the basic plumbing system and does not demand additional water supply or add any discharge load to the system. It is presumed that it performs some useful function in the operation, maintenance, servicing, economy or safety of the plumbing system. Examples include filters, relief valves and aerators.

[MP] PLUMBING FIXTURE. A receptacle or device that is connected to a water supply system or discharges to a drainage system or both. Such receptacles or devices require a supply of water; or discharge liquid waste or liquidborne solid waste; or require a supply of water and discharge waste to a drainage system.

[MP] PLUMBING SYSTEMS. Includes the water distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and building drains; in addition to their respective connections, devices and appurtenances within a structure or premises; and the water service, building sewer and building storm sewer serving such structure or premises.

[MP] POLLUTION. A low-hazard or nonhealth-hazard impairment of the quality of the potable water to a degree that does not create a hazard to the public health and that does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use.

[RB] POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, that in some cases contains fillers or reinforcements, that is used to clad exterior walls or buildings.

[MP] PORTABLE-FUEL-CELL APPLIANCE. A fuel cell generator of electricity that is not fixed in place. A portable-fuel-cell *appliance* utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

[RB] POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for the loading deflections of the *roof deck*, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

[MP] POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the public health authority having *jurisdiction*.

[RB] PRECAST CONCRETE. A structural concrete element cast elsewhere than its final position in the structure.

[RB] PRECAST CONCRETE FOUNDATION WALLS. Preengineered, *precast concrete* wall panels that are designed to withstand specified stresses and used to build below-*grade* foundations.

[MP] PRESS-CONNECT JOINT. A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion-resistant grip or bite ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.

[MP] PRESSURE-RELIEF VALVE. A pressure-actuated valve held closed by a spring or other means and designed to automatically relieve pressure at the pressure at which it is set.

[S][RE] PROPOSED DESIGN. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] PUBLIC SEWER. A common sewer directly controlled by public authority.

[MP] PUBLIC WATER MAIN. A water-supply pipe for public use controlled by public authority.

[RB] PUBLIC WAY. Any street, alley or other parcel of land open to the outside air leading to a public street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and that has a clear width and height of not less than 10 feet (3048 mm).

[MP] PURGE. To clear of air, gas or other foreign substances.

[MP] PUSH-FIT FITTING. A mechanical fitting that joins pipes or tubes and achieves a seal by mating the pipe or tube into the fitting.

[MP] QUICK-CLOSING VALVE. A valve or faucet that closes automatically where released manually or controlled by mechanical means for fast-action closing.

[RB] RAMP. A walking surface that has a running slope steeper than 1 unit vertical in 20 units horizontal (5-percent slope).

[S][RE] RATED DESIGN. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] READY ACCESS (TO). That which enables a device, *appliance* or equipment to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction.

[MP] RECEPTOR. A fixture or device that receives the discharge from indirect waste pipes.

[MP] RECLAIMED WATER. Nonpotable water that has been derived from the treatment of wastewater by a facility or system licensed or permitted to produce water meeting the *jurisdiction's* water requirements for its intended uses. Also known as "recycled water."

[S] REFLECTIVE DUCT INSULATION. A thermal insulation assembly consisting of one or more surfaces that have an emittance of 0.1 or less, and that bound an enclosed air space or spaces.

[MP] REFRIGERANT. A substance used to produce refrigeration by its expansion or evaporation.

[MP] REFRIGERANT COMPRESSOR. A specific machine, with or without accessories, for compressing a given refrigerant vapor.

[MP] REFRIGERATING SYSTEM. A combination of interconnected parts forming a closed circuit in which refrigerant is circulated for the purpose of extracting, then rejecting, heat. A direct refrigerating system is one in which the evaporator or condenser of the refrigerating system is in direct contact with the air or other substances to be cooled or heated. An indirect refrigerating system is one in which a secondary coolant cooled or heated by the refrigerating system is circulated to the air or other substance to be cooled or heated.

[RB] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or *jurisdiction* in which the project is to be constructed.

[MP] RELIEF VALVE, VACUUM. A device to prevent excessive buildup of vacuum in a pressure vessel.

[S][RB] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RB] REROOFING. The process of recovering or replacing an existing *roof covering*. See "*Roof recover*."

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] RESIDENTIAL BUILDING. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] RETURN AIR. Air removed from an *approved conditioned space* or location and recirculated or exhausted.

[RB] RIDGE. With respect to topographic wind effects, an elongated crest of a *hill* characterized by strong relief in two directions.

[MP] RISER (PLUMBING). A water pipe that extends vertically one full *story* or more to convey water to branches or to a group of fixtures.

[RB] RISER (STAIR). The vertical component of a step or *stair*.

[S][RB] ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a *roof covering* and *roof deck* or a single component serving as both the *roof covering* and the *roof deck*. A *roof assembly* can include an underlayment, thermal barrier, ignition barrier, insulation or a vapor retarder. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] ROOF COATING. A fluid-applied, adhered coating used for roof maintenance or *roof repair*, or as a component of a *roof covering* system or *roof assembly*.

[RB] ROOF COVERING. The covering applied to the *roof deck* for weather resistance, fire classification or appearance.

[RB] ROOF COVERING SYSTEM. See "*Roof assembly*."

[RB] ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

[S][RB] ROOF RECOVER. The process of installing an additional *roof covering* over an existing roof covering without removing the existing roof covering. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RB] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RB] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] ROOM HEATER. A free-standing heating *appliance* installed in the space being heated and not connected to ducts.

[MP] ROUGH-IN. The installation of the parts of the plumbing system that must be completed prior to the installation of fixtures. This includes DWV, water supply and built-in fixture supports.

[RB] RUNNING BOND. The placement of *masonry units* such that head joints in successive courses are horizontally offset not less than one-quarter the unit length.

[S][RE] *R*-VALUE (THERMAL RESISTANCE). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] SANITARY SEWER. A sewer that carries sewage and excludes storm, surface and groundwater.

[RB] SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

[RB] SEISMIC DESIGN CATEGORY (SDC). A classification assigned to a structure based on its occupancy category and the severity of the design earthquake ground motion at the site.

[MP] SEPTIC TANK. A watertight receptor that receives the discharge of a building sanitary drainage system and is constructed so as to separate solids from the liquid, digest organic matter through a period of detention, and allow the liquids to discharge into the soil outside of the tank through a system of open joint or perforated piping or a seepage pit.

[S][RE] SERVICE WATER HEATING. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][MP] SEWAGE. ((~~Any liquid waste containing animal matter, vegetable matter or other impurity in suspension or solution.~~)) All water-carried waste discharged from the sanitary facilities of buildings occupied or used by people.

[MP] SEWAGE PUMP. A permanently installed mechanical device for removing sewage or liquid waste from a sump.

[RB] SHALL. The term, where used in the code, is construed as mandatory.

[RB] SHEAR WALL. A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with Chapter 6 of this code and the associated limitations in Section R301.2 of this code.

[RB] SHINGLE FASHION. A method of installing roof or wall coverings, *water-resistive barriers*, flashing or other building components such that upper layers of material are placed overlapping lower layers of material to provide drainage and protect against water intrusion at unsealed penetrations and joints or in combination with sealed joints.

[RB] SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

[RB] SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

[S][RE] SKYLIGHT. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] SKYLIGHT, UNIT. A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the *roof assembly* while preserving the weather-resistant barrier of the roof.

[S][RB] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. *Unit skylights*, *tubular daylighting devices* and glazing materials in solariums, *sunrooms*, roofs and sloped walls are included in this definition. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] SLEEPING UNIT. A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a *dwelling unit* are not sleeping units.

[MP] SLIP JOINT. A mechanical-type joint used primarily on fixture traps. The joint tightness is obtained by compressing a friction-type washer such as rubber, nylon, neoprene, lead or special packing material against the pipe by the tightening of a (slip) nut.

[MP] SLOPE. The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent) for a length of pipe.

[W] SMALL BUSINESS. Any business entity (including a sole proprietorship, corporation, partnership or other legal entity) which is owned and operated independently from all other businesses, which has the purpose of making a profit, and which has fifty or fewer employees.

[RB] SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84 or UL 723.

[MP] SOIL STACK OR PIPE. A pipe that conveys sewage containing fecal material.

[RB] SOLAR ENERGY SYSTEM. A system that converts solar radiation to usable energy, including *photovoltaic panel systems* and *solar thermal systems*.

[S][RE] SOLAR HEAT GAIN COEFFICIENT (SHGC). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] SOLAR THERMAL COLLECTOR. Components in a *solar thermal system* that collect and convert solar radiation to thermal energy.

[MP] SOLAR THERMAL SYSTEM. A system that converts solar radiation to thermal energy for use in heating or cooling.

[RB] SOLID MASONRY. Load-bearing or nonload-bearing construction using *masonry units* where the net cross-sectional area of each unit in any plane parallel to the bearing surface is not less than 75 percent of its gross cross-sectional area. *Solid masonry* units shall conform to ASTM C55, C62, C73, C145 or C216.

[RB] SPLINE. A strip of wood structural panel cut from the same material used for the panel facings, used to connect two structural insulated panels. The strip (spline) fits into a groove cut into the vertical edges of the two structural insulated panels to be joined. Splines are used behind each facing of the structural insulated panels being connected as shown in Figure R610.8.

[MP] STACK. Any main vertical DWV line, including offsets, that extends one or more stories as directly as possible to its vent terminal.

[RB] STACK BOND. The placement of *masonry units* in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to all masonry laid in other than *running bond*.

[MP] STACK VENT. The extension of soil or waste stack above the highest horizontal drain connected.

[RB] STAIR. A change in elevation, consisting of one or more *risers*.

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another.

[RB] STAIRWAY, SPIRAL. A stairway with a plan view of closed circular form and uniform section-shaped treads radiating from a minimum-diameter circle.

[S][RE] STANDARD REFERENCE DESIGN. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] STANDARD TRUSS. Any construction that does not permit the roof-ceiling insulation to achieve the required *R*-value over the exterior walls.

[MP] STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages that constitute an automatically operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

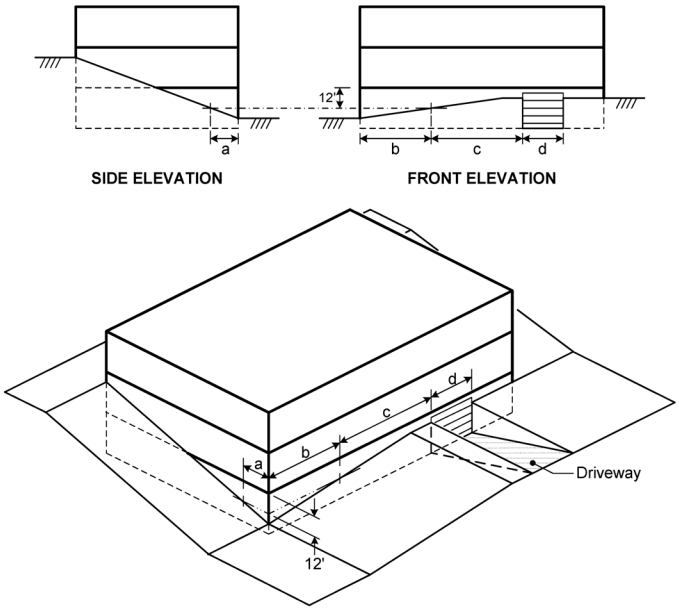
[MP] STORM SEWER, DRAIN. A pipe used for conveying rainwater, surface water, subsurface water and similar liquid waste.

[RB] STORM SHELTER. A building, structure or portion thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

[RB] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

[RB] STORY ABOVE GRADE PLANE. Any *story* having its finished floor surface entirely above *grade plane*, or in which the finished surface of the floor next above is either of the following:

1. More than 6 feet (1829 mm) above *grade plane.*
2. More than 12 feet (3658 mm) above the finished ground level at any point; or
3. More than 12 feet (3658 mm) above the finished ground level for more than 25 feet (7620 mm) of the perimeter. Required driveways up to 22 feet (6706 mm) shall not be considered in calculating the 25-foot distance if there are at least 10 feet (3048 mm) between the driveway and all portions of the 25-foot area. See Figure R202S.



a + b ≤ 25′

c ≥ 10′ Lowest level may be a *basement* below grade if all these are met

d ≤ 22′

FIGURE R202S
STORY ABOVE GRADE PLANE

[RB] STRUCTURAL COMPOSITE LUMBER. Structural members manufactured using wood elements bonded together with exterior adhesives.

Examples of structural composite lumber are:

Laminated strand lumber (LSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths are not less than 150 times the least dimension of the wood strand elements.

Laminated veneer lumber (LVL). A composite of wood veneer elements with wood fibers primarily oriented along the length of the member, where the veneer element thicknesses are 0.25 inch (6.4 mm) or less.

Oriented strand lumber (OSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths are not less than 75 times and less than 150 times the least dimension of the wood strand elements.

Parallel strand lumber (PSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.25 inch (6.4 mm) or less and their average lengths are not less than 300 times the least dimension of the wood strand elements.

[RB] STRUCTURAL INSULATED PANEL (SIP). A structural sandwich panel that consists of a lightweight foam plastic core securely laminated between two thin, rigid wood structural panel facings.

[RB] STRUCTURE. That which is built or constructed.

[RB] SUBSOIL DRAIN. A drain that collects subsurface water or seepage water and conveys such water to a place of disposal.

[MP] SUMP. A tank or pit that receives sewage or waste, located below the normal *grade* of the gravity system and that must be emptied by mechanical means.

[MP] SUMP PUMP. A pump installed to empty a sump. These pumps are used for removing storm water only. The pump is selected for the specific head and volume of the load and is usually operated by level controllers.

[RB] SUNROOM. A one-*story* structure attached to a *dwelling* with a *glazing area* in excess of 40 percent of the gross area of the structure's exterior walls and roof.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] SUPPLY AIR. Air delivered to a *conditioned space* through ducts or plenums from the heat exchanger of a heating, cooling or ventilating system.

[MP] SUPPORTS. Devices for supporting, hanging and securing pipes, fixtures and equipment.

[MP] SWEEP. A drainage fitting designed to provide a change in direction of a drain pipe of less than the angle specified by the amount necessary to establish the desired slope of the line. Sweeps provide a longer turning radius than bends and a less turbulent flow pattern (see "*Bend*" and "*Elbow*").

[MP] TEMPERATURE- AND PRESSURE-RELIEF (T AND P) VALVE. A combination relief valve designed to function as both a temperature-relief and pressure-relief valve.

[MP] TEMPERATURE-RELIEF VALVE. A temperature-actuated valve designed to discharge automatically at the temperature at which it is set.

[RB] TERMITE-RESISTANT MATERIAL. Pressure-preservative-treated wood in accordance with the AWPA standards in Section R317.1, naturally durable termite-resistant wood, steel, concrete, masonry or other *approved* material.

[S][RE] THERMAL ISOLATION. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RE] THERMAL RESISTANCE, *R*-VALUE. See "*R-value*."

[RE] THERMAL TRANSMITTANCE, *U*-FACTOR. See "*U-factor*."

[S][RE] THERMOSTAT. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] THIRD-PARTY CERTIFICATION AGENCY. An *approved* agency operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

[MP] THIRD-PARTY CERTIFIED. Certification obtained by the manufacturer indicating that the function and performance characteristics of a product or material have been determined by testing and ongoing surveillance by an *approved* third-party certification agency. Assertion of certification is in the form of identification in accordance with the requirements of the third-party certification agency.

[RB] TOWNHOUSE. A *building* that contains three or more attached *townhouse units*.

[W][RB] TOWNHOUSE UNIT. A single-family *dwelling unit* in a *townhouse* that extends from foundation to roof and that has a *yard* or *public way* on not less than two sides that extends at least 50 percent of the length of each of these two sides.

[MP] TRAP. A fitting, either separate or built into a fixture, that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or wastewater through it.

[MP] TRAP ARM. That portion of a *fixture drain* between a trap weir and the vent fitting.

[MP] TRAP PRIMER. A device or system of piping to maintain a water seal in a trap, typically installed where infrequent use of the trap would result in evaporation of the trap seal, such as floor drains.

[MP] TRAP SEAL. The trap seal is the maximum vertical depth of liquid that a trap will retain, measured between the crown weir and the top of the dip of the trap.

[RB] TRIM. Picture molds, chair rails, baseboards, *handrails*, door and window frames, and similar decorative or protective materials used in fixed applications.

[RB] TRUSS DESIGN DRAWING. The graphic depiction of an individual truss, that describes the design and physical characteristics of the truss.

[RB] TUBULAR DAYLIGHTING DEVICE (TDD). A nonoperable fenestration unit primarily designed to transmit daylight from a roof surface to an interior ceiling via a tubular conduit. The basic unit consists of an exterior glazed weathering surface, a light-transmitting tube with a reflective interior surface, and an interior-sealing device such as a translucent ceiling panel. The unit may be factory assembled, or field assembled from a manufactured kit.

[MP] TYPE L VENT. A *listed* and *labeled* vent conforming to UL 641 for venting oil-burning *appliances listed* for use with Type L vents or with gas *appliances listed* for use with Type B vents.

[S][RE] *U*-FACTOR (THERMAL TRANSMITTANCE). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other *approved* material over which a roof covering, with a slope of 2 units vertical in 12 units horizontal (17-percent slope) or greater, is applied.

[S] UNSAFE. Structurally unsound, provided with inadequate egress, constituting a fire hazard, or otherwise dangerous to human life, or constituting a hazard to safety, health, or public welfare.

[MP] VACUUM BREAKER. A device that prevents back-siphonage of water by admitting atmospheric pressure through ports to the discharge side of the device.

[RB] VAPOR DIFFUSION PORT. An assembly constructed or installed within a *roof assembly* at an opening in the *roof deck* to convey water vapor from an unvented attic to the outside atmosphere.

[RB] VAPOR PERMEABLE. The property of having a moisture vapor permeance rating of 5 perms (2.9×10^{-10} kg/Pa × s × m^2) or greater, where tested in accordance with Procedure A or Procedure B of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

[RB] VAPOR RETARDER CLASS. A measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E96 as follows:

Class I: ≤ 0.1 perm rating

Class II: > 0.1 to ≤ 1.0 perm rating

Class III: > 1.0 to ≤ 10 perm rating

[MP] VENT. A passageway for conveying flue gases from fuel-fired *appliances*, or their vent connectors, to the outside atmosphere.

[MP] VENT COLLAR. See "*Flue collar*."

[MP] VENT CONNECTOR. That portion of a venting system that connects the flue collar or draft hood of an *appliance* to a vent.

[MP] VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual, automatically operated fuel-burning *appliance* and that is designed to open the venting system automatically where the *appliance* is in operation and to close off the venting system automatically where the *appliance* is in a standby or shutdown condition.

[MP] VENT GASES. Products of combustion from fuel-burning *appliances*, plus excess air and dilution air, in the venting system above the draft hood or draft regulator.

[MP] VENT STACK. A vertical vent pipe installed to provide circulation of air to and from the drainage system and that extends through one or more stories.

[MP] VENT SYSTEM. Piping installed to equalize pneumatic pressure in a drainage system to prevent trap seal loss or blow-back due to siphonage or back pressure.

[S][RB] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[S][RE] VENTILATION AIR. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[MP] VENTING. Removal of combustion products to the outdoors.

[MP] VENTING SYSTEM. A continuous open passageway from the flue collar of an *appliance* to the outside atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

[MP] VERTICAL PIPE. Any pipe or fitting that makes an angle of 45 degrees (0.79 rad) or more with the horizontal.

[RB] VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used to cover exterior walls of buildings.

[S][RE] VISIBLE TRANSMITTANCE (VT). For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] WALL, RETAINING. A wall not laterally supported at the top, that resists lateral soil load and other imposed loads.

[RB] WALLS. Walls shall be defined as follows:

Load-bearing wall. A wall supporting any vertical load in addition to its own weight.

Nonbearing wall. A wall which does not support vertical loads other than its own weight.

[MP] WASTE. Liquidborne waste that is free of fecal matter.

[MP] WASTE PIPE OR STACK. Piping that conveys only liquid sewage not containing fecal material.

[MP] WASTE RECEPTOR. A floor sink, standpipe, hub drain or a floor drain that receives the discharge of one or more indirect waste pipes.

[MP] WATER DISTRIBUTION SYSTEM. Piping that conveys water from the service to the plumbing fixtures, *appliances*, appurtenances, equipment, devices or other systems served, including fittings and control valves.

[S][MP] WATER HEATER. Any listed heating *appliance* or equipment that heats potable water and supplies such water to the potable hot water distribution system ((.)) excluding any *appliance* or *equipment* that exceeds any of the following:

1. An operating temperature of 210 degrees F (99 degrees C);
2. A maximum allowable working pressure of 160 pounds per square inch (1103 kPa);
3. A volume of 120 gallons (454 L); or
4. A heat input of 200,000 Btu/hr (58.6 kW).

Any *appliance* or *equipment* that exceeds any one of these values is classified as a *boiler*.

[MP] WATER MAIN. A water supply pipe for public use.

[MP] WATER OUTLET. A valved discharge opening, including a hose bibb, through which water is removed from the potable water system supplying water to a plumbing fixture or plumbing *appliance* that requires either an *air gap* or backflow prevention device for protection of the supply system.

[MP] WATER SERVICE PIPE. The outside pipe from the water main or other source of potable water supply to the water distribution system inside the building, terminating at the service valve.

[MP] WATER SUPPLY SYSTEM. The water service pipe, the water-distributing pipes and the necessary connecting pipes, fittings, control valves and appurtenances in or adjacent to the building or premises.

[RB] WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

[MP] WET VENT. A vent that receives the discharge of wastes from other fixtures.

[W][S][MP] WHOLE-HOUSE ((~~MECHANICAL~~)) VENTILATION SYSTEM. ((~~An exhaust system, supply~~)) A mechanical ventilation system, ((~~or combination thereof that is designed to mechanically exchange indoor air for outdoor air where operating continuously or through a programmed intermittent schedule to satisfy the whole-house ventilation rate~~)) including fans, controls, and ducts, which replaces, by direct means, air from the habitable rooms with outdoor air.

For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

[RB] WINDBORNE DEBRIS REGION. Areas within *hurricane-prone regions* located in accordance with one of the following:

1. Within 1 mile (1.61 km) of the coastal mean high-water line where the ultimate design wind speed, V_{ult}, is 130 mph (58 m/s) or greater.
2. In areas where an Exposure D condition exists upwind at the waterlne and the ultimate design wind speed, V_{ult}, is 140 mph (63 m/s) or greater; or Hawaii.

[RB] WINDER. A tread with nonparallel edges.

[RB] WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, orientated strand board (OSB) or composite panels.

[RB] YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the *lot* on which a building is situated.

[S][RE] ZONE. For the definition applicable ((~~in Chapter 11~~)) to the *Seattle Residential Energy Code*, see Section ((~~N1101.6~~)) R202 in the residential section of the *Seattle Energy Code*.

Part III—Building Planning and Construction

CHAPTER 3

BUILDING PLANNING

User note:

About this chapter: *Chapter 3 contains a wide array of building planning requirements that are critical to designing a safe and usable building. This includes, but is not limited to, requirements related to general structural design, fire-resistant construction, light, ventilation, sanitation, plumbing fixture clearances, minimum room area and ceiling height, safety glazing, means of egress, automatic fire sprinkler systems, smoke and carbon monoxide alarm systems, accessibility, solar energy systems, swimming pools, spas and hot tubs.*

SECTION R301
DESIGN CRITERIA

R301.1 Application. Buildings and structures, and parts thereof, shall be constructed to safely support all loads, including dead loads, *live loads*, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets the requirements for the transfer of loads from their point of origin through the load-resisting elements to the foundation. Buildings and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.

R301.1.1 Alternative provisions. As an alternative to the requirements in Section R301.1, the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards, the design shall comply with the *International Building Code*.

1. AWC *Wood Frame Construction Manual* (WFCM).
2. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).
3. ICC *Standard on the Design and Construction of Log Structures* (ICC 400).

R301.1.2 Construction systems. The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

R301.1.3 Engineered design. Where a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *International Building Code* is permitted for buildings and structures, and parts thereof, included in the scope of this code.

R301.1.4 Intermodal shipping containers. Intermodal shipping containers that are repurposed for use as buildings or structures shall be designed in accordance with the structural provisions in Section 3115 of the *International Building Code*.

[W][S] R301.2 Climatic and geographic design criteria. Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria ((~~shall be~~)) <u>are</u> established ((~~by the local *jurisdiction* and set forth~~)) in Table R301.2.

[S] TABLE R301.2
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[o] (pg)	WIND DESIGN				SEISMIC DESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEAN ANNUAL TEMP[j]
	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Windborne debris zone[m]		Weathering[a]	Frost line depth[b]	Termite[c]				
((—)) 20 psf	((—)) 98	((—)) Yes	((—)) No	((—)) No	((—)) D_2	((—)) Moderate	((—)) 12"	((—)) none to slight	((—)) No	((—)) (a) 1989 (b) May 16, 1995	((—)) 250	((—)) 52.8º F

MANUAL J DESIGN CRITERIA[n]						
Elevation	Altitude correction factor[e]	Coincident wet bulb	Indoor winter design dry-bulb temperature	Indoor winter design dry-bulb temperature	Outdoor winter design dry-bulb temperature	Heating temperature difference
—	—	—	—	—	—	—
Latitude	Daily range	Indoor summer design relative humidity	Summer design gains	Indoor summer design dry-bulb temperature	Outdoor summer design dry-bulb temperature	Cooling temperature difference
—	—	—	—	—	—	—

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(1). The grade of masonry units shall be determined from ASTM C34, ASTM C55, ASTM C62, ASTM C73, ASTM C90, ASTM C129, ASTM C145, ASTM C216 or ASTM C652.

b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.

c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.

d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(2). Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.

e. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.

g. The jurisdiction shall fill in this part of the table with: the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas); and the title and date of the currently effective Flood Insurance Study or other flood hazard study and maps adopted by the authority having jurisdiction, as amended. Flood hazard areas include areas mapped by Seattle Public Utilities.

h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."

i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

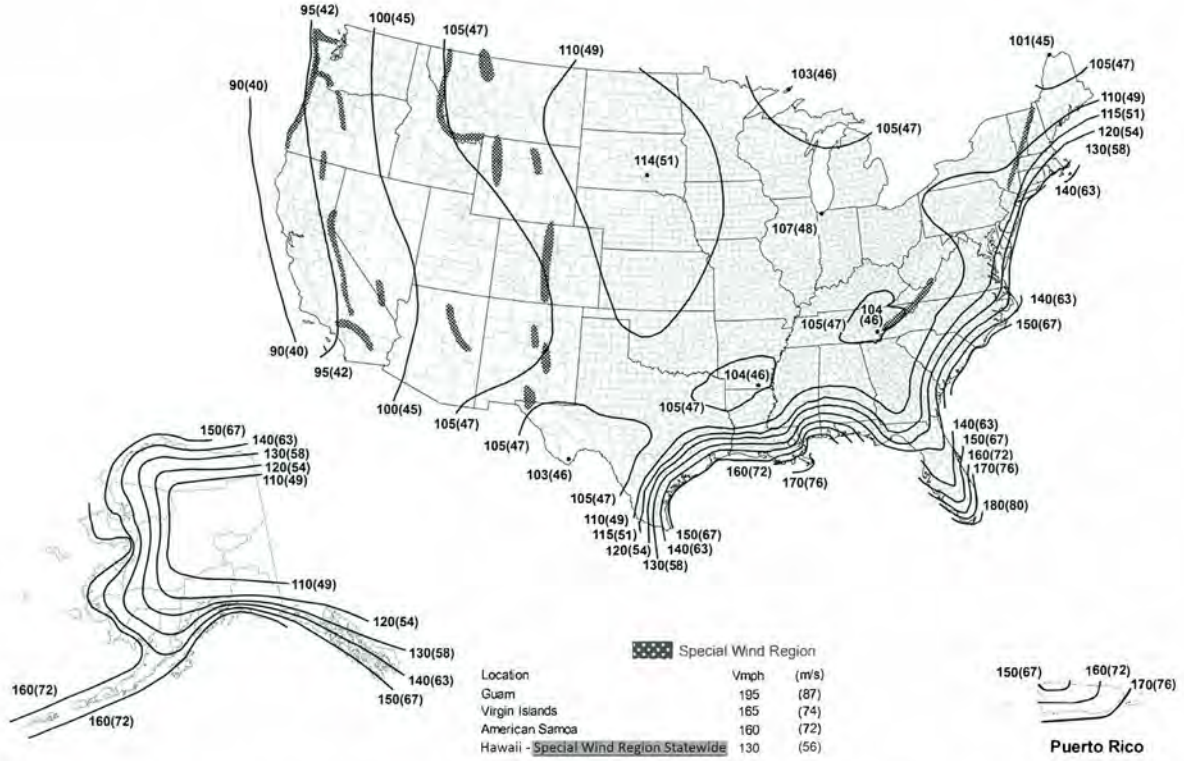
l. In accordance with Figure R301.2(2), where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.

o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figures R301.2(3) and R301.2(4). As an alternate to calculating roof snow loads and drifts based on the ground snow load (pg, per ASCE 7) shown in Table R301.2, a uniform flat roof snow load of 25 psf may be used (pf, per ASCE 7).

p. The interior and exterior design conditions used for heating and cooling load calculations are located in Section R302.1 of the Seattle Energy Code – Residential.



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

FIGURE R301.2(2)
((~~ULTIMATE DESIGN WIND SPEEDS~~)) BASIC WIND SPEEDS

Missile Test of ASTM E1886 and ASTM E1996 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

Exception: *Wood structural panels* with a thickness of not less than 7/16 inch (11 mm) and a span of not more than 8 feet (2438 mm) shall be permitted for opening protection. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2.1(1) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 45 feet (13 728 mm) or less where the ultimate design wind speed, V_{ult}, is 180 mph (290 kph) or less.

TABLE R301.2.1.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)[a, b]		
	Panel span ≤ 4 feet	4 feet < panel span ≤ 6 feet	6 feet < panel span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
1/4-inch lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

a. This table is based on 180 mph ultimate design wind speeds, V_{ult}, and a 45-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.

c. Anchors shall penetrate through the exterior wall covering with an embedment length of not less than 2 inches into the building frame. Fasteners shall be located not less than 2-1/2 inches from the edge of concrete block or concrete.

d. Panels attached to masonry or masonry/stucco shall be attached using vibration-resistant anchors having an ultimate withdrawal capacity of not less than 1,500 pounds.

R301.2.1.2.1 Application of ASTM E1996. The text of Section 2.2 of ASTM E1996 shall be substituted as follows:

2.2 ASCE Standard:

ASCE 7-10 American Society of Civil Engineers *Minimum Design Loads for Buildings and Other Structures*

The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the ultimate design wind speed, V_{ult}, as follows:

6.2.2.1 Wind Zone 1–130 mph ≤ ultimate design wind speed, V_{ult} < 140 mph.

6.2.2.2 Wind Zone 2–140 mph ≤ ultimate design wind speed, V_{ult} < 150 mph at greater than 1 mile (1.6 km) from the coastline. The coastline shall be measured from the mean high-water mark.

6.2.2.3 Wind Zone 3–150 mph (67 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 170 mph (76 m/s), or 140 mph (54 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 170 mph (76 m/s) and within 1 mile (1.6 km) of the coastline. The coastline shall be measured from the mean high-water mark.

6.2.2.4 Wind Zone 4–ultimate design wind speed, V_{ult} > 170 mph (76 m/s).

R301.2.1.3 Wind speed conversion. Where referenced documents are based on nominal design wind speeds and do not provide the means for conversion between ultimate design wind speeds and nominal design wind speeds, the ultimate design wind speeds, V_{ult}, of Figure R301.2(2) shall be converted to nominal design wind speeds, V_{asd}, using Table R301.2.1.3.

TABLE R301.2.1.3
WIND SPEED CONVERSIONS[a]

V_{ult}	110	115	120	130	140	150	160	170	180	190	200
V_{asd}	85	89	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.447 m/s.

a. Linear interpolation is permitted.

[S] R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography

and vegetation as well as from constructed features. For a site where multiple detached one- and two-family *dwellings*, townhouses or other structures are to be constructed as part of a subdivision or master-planned community, or are otherwise designated as a developed area by the authority having *jurisdiction*, the exposure category for an individual structure shall be based on the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided that their construction is expected to begin within 1 year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

((~~1. Exposure B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family *dwellings* or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.~~

~~2. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat, open country and grasslands.~~

~~3. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water, smooth mud flats, salt flats and unbroken ice for a distance of not less than 5,000 feet (1524 m). This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the unobstructed area. Exposure D extends downwind from the edge of the unobstructed area a distance of 600 feet (183 m) or 20 times the height of the building or structure, whichever is greater.~~))

1. Exposure B. Exposure B shall apply for all cases where Exposure C does not apply.
2. Exposure C. Exposure C shall apply along the shorelines where the ground surface roughness, as defined by Surface Roughness D, prevails in the following conditions:
    1. The upwind direction of the shoreline is exposed to winds coming from the south through west (180 degrees to 270 degrees); and
    2. The distance of Surface Roughness D is at least 5,000 feet (1524 m).

    Exposure C extends a distance of 600 feet (183 m) from the shoreline as defined in the previous sentence.
3. Exposure D. Exposure D shall not apply anywhere within the City of Seattle.

Interpretation IR301.2.1.4: A map of the Exposure C areas is provided at https://www.seattle.gov/sdci/resources/wind-load-factors.

R301.2.1.5 Topographic wind effects. In areas designated in Table R301.2 as having local historical data documenting structural damage to buildings caused by wind speed-up at isolated *hills*, ridges and escarpments that are abrupt changes from the general topography of the area, topographic wind effects shall be considered in the design of the building in accordance with Section R301.2.1.5.1 or in accordance with the provisions of ASCE 7. See Figure R301.2.1.5.1(1) for topographic features for wind speed-up effect.

In these designated areas, topographic wind effects shall apply only to buildings sited on the top half of an isolated *hill*, *ridge* or escarpment where all of the following conditions exist:

1. The average slope of the top half of the *hill*, *ridge* or escarpment is 10 percent or greater.
2. The *hill*, *ridge* or escarpment is 60 feet (18 288 mm) or greater in height for Exposure B, 30 feet (9144 mm) or greater in height for Exposure C, and 15 feet (4572 mm) or greater in height for Exposure D.
3. The *hill*, *ridge* or escarpment is isolated or unobstructed by other topographic features of similar height in the upwind direction for a distance measured from its high point of 100 times its height or 2 miles (3.2 km), whichever is less. See Figure R301.2.1.5.1(3) for upwind obstruction.
4. The *hill*, *ridge* or escarpment protrudes by a factor of two or more above the height of other upwind topographic features located in any quadrant within a radius of 2 miles (3.2 km) measured from its high point.

R301.2.1.5.1 Simplified topographic wind speed-up method. As an alternative to the ASCE 7 topographic wind provisions, the provisions of Section R301.2.1.5.1 shall be permitted to be used to design for wind speed-up effects, where required by Section R301.2.1.5.

Structures located on the top half of isolated *hills*, ridges or escarpments meeting the conditions of Section R301.2.1.5 shall be designed for an increased basic wind speed as determined by Table R301.2.1.5.1. On the high side of an escarpment, the increased basic wind speed shall extend horizontally downwind from the edge of the escarpment 1.5 times the horizontal length of the upwind slope (1.5L) or 6 times the height of the escarpment (6H), whichever is greater. See Figure R301.2.1.5.1(2) for where wind speed increase is applied.

Code Alternate CA301.2.1.5.1:
Topographic Factor Maps. As an alternative to the requirements in R301.2.1.5.1 structures shall be permitted to be designed for an increased basic wind speed as determined by the following equation:

$$V = V_{ult}\sqrt{K_{zt}}$$

K_{zt}, the topographic factor, shall be permitted to be obtained from ASCE 7 or rules promulgated by the building official.

Interpretation CA301.2.1.5.1: As an alternative to obtaining the topographic factor K_{zt} from ASCE 7, it shall be permitted to obtain the default topographic factors from the Wind Load Factors map provided at https://www.seattle.gov/sdci/resources/wind-load-factors.

TABLE R301.2.1.5.1
ULTIMATE DESIGN WIND SPEED MODIFICATION FOR TOPOGRAPHIC WIND EFFECT[a, b]

ULTIMATE DESIGN WIND SPEED FROM FIGURE R301.2(2) (mph)	AVERAGE SLOPE OF THE TOP HALF OF HILL, RIDGE OR ESCARPMENT (percent)						
	0.10	0.125	0.15	0.175	0.20	0.23	0.25
	Required ultimate design wind ((~~speed up~~)) speed, modified for topographic wind speed-up (mph)						
95	114	119	123	127	131	137	140
100	120	125	129	134	138	144	147
105	126	131	135	141	145	151	154
110	132	137	142	147	152	158	162
115	138	143	148	154	159	165	169
120	144	149	155	160	166	172	176
130	156	162	168	174	179	NA	NA
140	168	174	181	NA	NA	NA	NA
150	180	NA	NA	NA	NA	NA	NA

For SI: 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.
NA = Not Applicable.
a. Table applies to a feature height of 500 feet or less and dwellings sited a distance equal or greater than half the feature height.
b. Where the ultimate design wind speed as modified by Table R301.2.1.5.1 equals or exceeds 140 miles per hour, the building shall be considered as "wind design required" in accordance with Section R301.2.1.1.

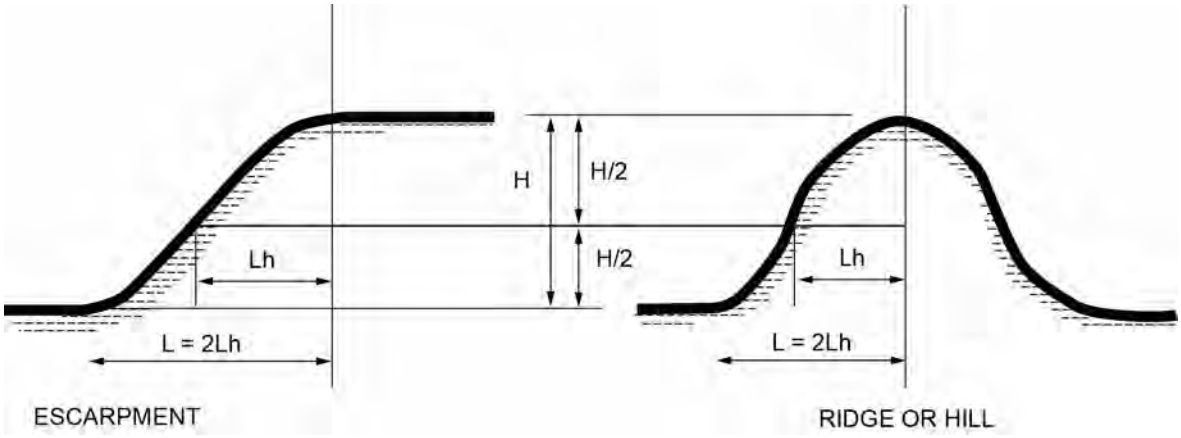


FIGURE R301.2.1.5.1(1)
TOPOGRAPHIC FEATURES FOR WIND SPEED-UP EFFECT

7. **Wall bracing in stories containing masonry or concrete construction.** Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

   Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. **Hillside *light-frame construction*.** Conditions in which all of the following apply:

   8.1. The grade slope exceeds 1 unit vertical in 5 units horizontal where averaged across the full length of any side of the dwelling.

   8.2. The tallest cripple wall clear height exceeds 7 feet (2134 mm), or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7 feet (2134 mm).

   8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50 percent is living space having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including connections to the foundation and design of the foundation to transfer lateral loads from the framing above.

Exception: *Light-frame construction* in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

R301.2.2.7 Height limitations. Wood-framed buildings shall be limited to three *stories* above *grade plane* or the limits given in Table R602.10.3(3). Wood-framed buildings in Seismic Design Category D_2 exceeding two *stories* shall be designed for wind and seismic loads in accordance with accepted engineering practice. Cold-formed steel-framed buildings shall be limited to less than or equal to three *stories* above *grade plane* in accordance with AISI S230. *Mezzanines* as defined in Section R202 that comply with Section R325 shall not be considered as *stories*. *Structural insulated panel* buildings shall be limited to two *stories* above *grade plane*.

R301.2.2.8 Cold-formed steel framing in Seismic Design Categories D_0, D_1 and D_2. In *Seismic Design Categories* D_0, D_1 and D_2 in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of AISI S230.

R301.2.2.9 Masonry chimneys. In *Seismic Design Categories* D_0, D_1 and D_2, masonry chimneys shall be reinforced and anchored to the building in accordance with Sections R1003.3 and R1003.4.

[W] R301.2.2.10 Anchorage of water heaters. In *Seismic Design Categories* D_0, D_1 and D_2, and in *townhouses* in Seismic Design Category C, water heaters and thermal storage units shall be anchored against movement and overturning in accordance with Section M1307.2 or ((~~P2801.8~~)) the Uniform Plumbing Code Section 507.2.

R301.2.3 Snow loads. Wood-framed construction, cold-formed, steel-framed construction and masonry and concrete construction, and *structural insulated panel* construction in regions with ground snow loads 70 pounds per square foot (3.35 kPa) or less, shall be in accordance with Chapters 5, 6 and 8. Buildings in regions with ground snow loads greater than 70 pounds per square foot (3.35 kPa) shall be designed in accordance with accepted engineering practice.

R301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2, and substantial improvement and *repair* of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with Section R322. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R301.2.4.1 Alternative provisions. As an alternative to the requirements in Section R322, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

   Exception: A *story height* not exceeding 13 feet 7 inches (4140 mm) is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the build-

ing is in accordance with Section R602.10. Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.

2. For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).
3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

   Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.
4. For insulating concrete form walls, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per *story* as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).
5. For structural insulated panel (SIP) walls, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per *story* as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6, provided that the *story heights* of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the *International Building Code*.

R301.4 Dead load. The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

R301.5 Live load. The minimum uniformly distributed *live load* shall be as provided in Table R301.5.

[W][S] TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)

USE	UNIFORM LOAD (psf)	CONCENTRATED LOAD (lb)
Uninhabitable attics without storage[b]	10	—
Uninhabitable attics with limited storage[b, g]	20	—
Habitable attics and attics served with fixed stairs	30	—
Balconies (exterior) and decks[e]	((~~40~~)) 60[i]	—
Fire escapes	40	—
Guards	—	200[h, i]
Guard in-fill components[f]	—	50[h]
Handrail[d]	200[h]	—
Passenger vehicle garages[a]	50[a]	2,000[h]
Areas other than sleeping areas	40	—
Sleeping areas	30	—
Stairs	40[c]	300[c]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2, 1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting the uniformly distributed live load or a 2,000-pound concentrated load applied on an area of 4-1/2 inches by 4-1/2 inches, whichever produces the greater stresses.

b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.

c. Individual stair treads shall be capable of supporting the uniformly distributed live load or a 300-pound concentrated load applied on an area of 2 inches by 2 inches, whichever produces the greater stresses.

d. A single concentrated load applied in any direction at any point along the top. For a guard not required to serve as a handrail, the load need not be applied to the top element of the guard in a direction parallel to such element.

e. See Section R507.1 for decks attached to exterior walls.

f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.

   The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

   1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
   2. The slopes of the joists or truss bottom chords are not greater than 2 units vertical in 12 units horizontal.
   3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.

h. Glazing used in handrail assemblies and guards shall be designed with a load adjustment factor of 4. The load adjustment factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

i. Where the top of a guard system is not required to serve as a handrail, the single concentrated load shall be applied at any point along the top, in the vertical downward direction and in the horizontal direction away from the walking surface. Where the top of a guard is also serving as the handrail, a single concentrated load shall be applied in any direction at any point along the top. Concentrated loads shall not be applied concurrently.

j. Where structural tables in Section R507 only specify snow loads, the values corresponding to 70 psf snow loads shall be used.

R301.6 Roof load. The roof shall be designed for the *live load* indicated in Table R301.6 or the ground snow load indicated in Table R301.2, whichever is greater.

TABLE R301.6
MINIMUM ROOF LIVE LOADS IN POUNDS-FORCE PER SQUARE FOOT OF HORIZONTAL PROJECTION

ROOF SLOPE	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa, 1 inch per foot = 83.3 mm/m.

R301.7 Deflection. The allowable deflection of any structural member under the *live load* listed in Sections R301.5 and R301.6 or wind loads determined by Section R301.2.1 shall not exceed the values in Table R301.7.

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS[b, c]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with finished ceiling not attached to rafters	*L*/180
Interior walls and partitions	*H*/180
Floors	*L*/360
Ceilings with brittle finishes (including plaster and stucco)	*L*/360
Ceilings with flexible finishes (including gypsum board)	*L*/240
All other structural members	*L*/240
Exterior walls—wind loads[a] with plaster or stucco finish	*H*/360
Exterior walls—wind loads[a] with other brittle finishes	*H*/240
Exterior walls—wind loads[a] with flexible finishes	*H*/120[d]
Lintels supporting masonry veneer walls[e]	*L*/600

Note: *L* = span length, *H* = span height.

a. For the purpose of the determining deflection limits herein, the wind load shall be permitted to be taken as 0.7 times the component and cladding (ASD) loads obtained from Table R301.2.1(1).

b. For cantilever members, *L* shall be taken as twice the length of the cantilever.

c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed *L*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *L*/175 for each glass lite or *L*/60 for the entire length of the member, whichever is more stringent. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *L*/120.

d. Deflection for exterior walls with interior gypsum board finish shall be limited to an allowable deflection of *H*/180.

e. Refer to Section R703.8.2. The dead load of supported materials shall be included when calculating the deflection of these members.

R301.8 Nominal sizes. For the purposes of this code, dimensions of lumber specified shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

SECTION R302
FIRE-RESISTANT CONSTRUCTION

[S] R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from *permits* by Section R105.2 are not required to provide ((~~wall~~)) protection based on location on the *lot*. Projections beyond the exterior wall shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

Interpretation R302.1: For purposes of Section R302.1, gutters 6 inches (152 mm) or less in width that are not an integral part of the structure are not considered projections.

[W] TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the *International Building Code* with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[a, b]	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ((~~gable vent~~)) ventilation openings are not installed in the rake overhang or in walls that are common to attic areas.

[W] TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code* with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c]	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.

c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ((~~gable vent~~)) ventilation openings are not installed in the rake overhang or in walls that are common to attic areas.

[W] R302.2 Townhouses. Walls separating *townhouse units* shall be constructed in accordance with Section R302.2.1 or R302.2.2 and shall comply with Sections 302.2.3 through 302.2.5.

R302.2.1 Double walls. Each *townhouse unit* shall be separated from other *townhouse units* by two 1-hour fire-resistance-rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code.*

[S] R302.2.2 Common walls. Common walls separating *townhouse units* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two *townhouse units* shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall. Electrical installations shall be in accordance with ((~~Chapters 34 through 43~~)) the Seattle Electrical Code. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where an automatic sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section ((~~703.2.2~~)) 703.3 of the *International Building Code*.
2. Where an automatic sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section ((~~703.2.2~~)) 703.3 of the *International Building Code*.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two 2-inch nominal thickness wood studs.

[W] R302.2.3 Continuity. The fire-resistance-rated wall or assembly separating *townhouse units* shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed *accessory structures*.

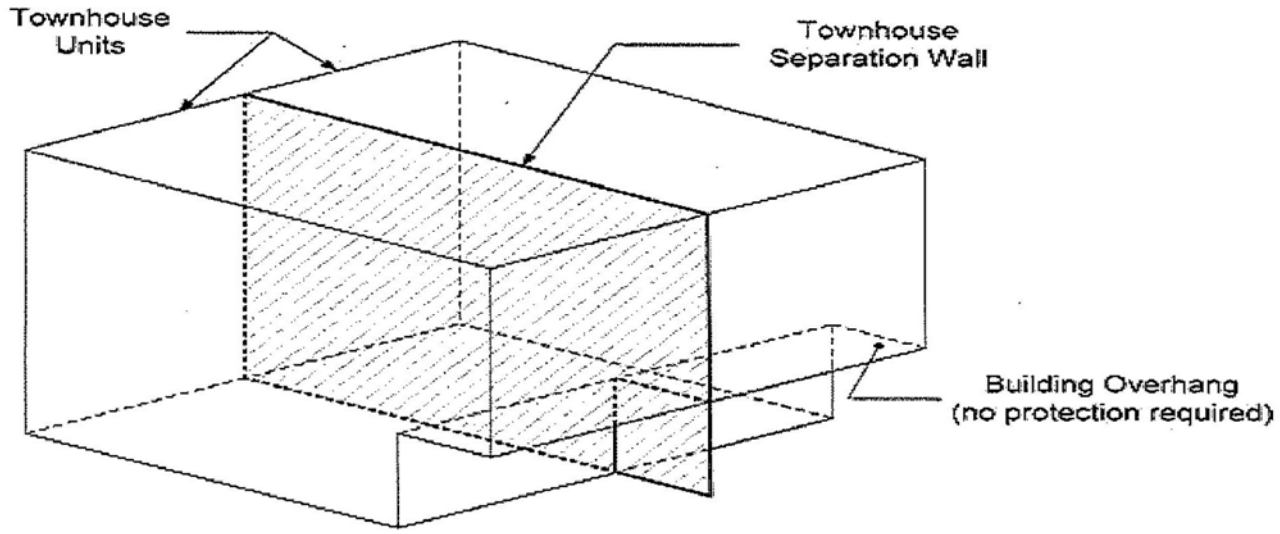
Where a story extends beyond the exterior wall of a story below:

1. The fire-resistance-rated wall or assembly shall extend to the outside edge of the upper story (see Figure R302.2(1)); or
2. The underside of the exposed floor-ceiling assembly shall be protected as required for projections in Section R302 (see Figure R302.2(2)).

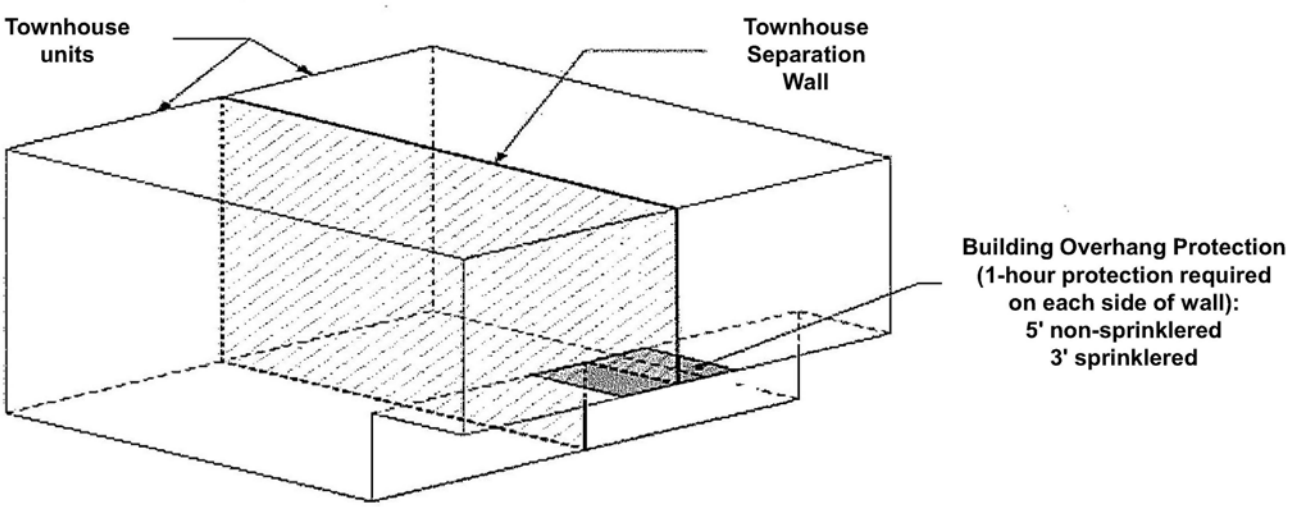
R302.2.4 Parapets for townhouses. Parapets constructed in accordance with Section R302.2.5 shall be constructed for *townhouses* as an extension of exterior walls or common walls separating *townhouse units* in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

   Exception: A parapet is not required in the preceding two cases where the roof covering complies with a minimum Class C rating as tested in accordance with ASTM E108 or UL 790 and the roof decking or sheathing is of *noncombustible materials* or fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of 5/8-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by not less than nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a distance of not less than 4 feet (1219 mm) on each side of the wall or walls and any openings or penetrations in the roof are not within 4 feet (1219 mm) of the common walls. Fire-retardant-treated wood shall meet the requirements of Sections R802.1.5 and R803.2.1.2.
3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher *roof deck* shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.



[W] FIGURE R302.2(1)
EXTENDED TOWNHOUSE SEPARATION WALL



[W] FIGURE R302.2(2)
TOWNHOUSE SEPARATION OVERHANG PROTECTION

R302.2.5 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), and the height shall be not less than 30 inches (762 mm).

((~~R302.2.6 Structural independence.~~ ~~Each *townhouse unit* shall be structurally independent.~~

~~Exceptions:~~

1. ~~Foundations supporting exterior walls or common walls.~~
2. ~~Structural roof and wall sheathing from each unit fastened to the common wall framing.~~
3. ~~Nonstructural wall and roof coverings.~~
4. ~~Flashing at termination of roof covering over common wall.~~
5. ~~*Townhouse units* separated by a common wall as provided in Section R302.2.2, Item 1 or 2.~~

~~6. *Townhouse units* protected by a fire sprinkler system complying with Section P2904 or NFPA 13D.~~))

[W] R302.3 Two-family dwellings. Wall and floor/ceiling assemblies separating dwelling units in two-family dwellings shall be constructed in accordance with Section R302.3.1 through R302.3.5.3. One accessory dwelling unit constructed within an existing dwelling unit need not be considered a separated dwelling unit in a two-family dwelling where all required smoke alarms, in the accessory dwelling unit and the primary dwelling unit, are interconnected in such a manner that the actuation of one alarm will activate all alarms in both the primary dwelling unit and the accessory dwelling unit.

Interpretation I-R302.3. An accessory dwelling unit within an existing or new two-family dwelling is considered a separate dwelling unit and exceeds the unit count allowed by the *Seattle Residential Code*.

[W][S] R302.3.1 Separation. *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code*. Such separation shall be provided regardless of whether a *lot line* exists between the two *dwelling units* or not. ((~~Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.~~))

Exceptions:

1. A fire-resistance rating of 1/2 hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with ((~~Section P2904~~)) NFPA 13D.
2. Where an accessory dwelling unit is added within an existing single-family residence to create a two-family dwelling, fire rated separation between the accessory dwelling unit and the primary dwelling unit is not required when all required smoke alarms are interconnected in such a manner that the actuation of one alarm will activate all alarms in both the primary dwelling unit and the accessory dwelling unit.

[W] R302.3.2 Continuity. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

((~~2.~~)) **Exception:** Wall assemblies need not extend through attic spaces where the ceiling is protected by not less than 5/8-inch (15.9 mm) Type X gypsum board, an attic draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings* and the structural framing supporting the ceiling is protected by not less than 1/2-inch (12.7 mm) gypsum board or equivalent.

[W][S] ((~~R302.3.1~~)) R302.3.3 Supporting construction. Where floor/ceiling assemblies are required to be fire-resistance rated by Section R302.3, the supporting construction of such assemblies shall have an equal or greater fire-resistance rating.

Exception: The supporting construction is not required to be fire-resistance rated where automatic fire sprinklers are installed in accordance with Section P2904 and NFPA 13 in both *dwelling units*.

[W] R302.3.4 Openings protection between two-family dwellings. Openings in the common fire-resistance-rated wall assembly located between units of a two-family dwelling shall be equipped with not less than a 45-minute fire-rated door assembly equipped with a self-closing or automatic-closing device.

Exception: A 20-minute fire-rated door assembly is permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section P2904 or 13D.

[W] R302.3.5 Shared accessory rooms. Shared accessory rooms shall be separated from each individual dwelling unit in accordance with Table R302.3.5. Openings between the shared accessory room and dwelling unit shall comply with Section R302.3.5.1. Attachment of gypsum board shall comply with Table R702.3.5.

[W] R302.3.5.1 Opening protection. Openings from a shared accessory room or area directly into a room used for sleeping purposes shall not be permitted. Other openings between the shared accessory room or area shall be equipped with solid wood doors not less than 1-3/8 inches in thickness, solid or honeycomb core steel doors not less than 1-3/8 inches thick, or a fire door assembly with a 20-minute fire-protection rating, equipped with a self-closing or automatic-closing device.

[W] R302.3.5.2 Duct penetration. Ducts penetrating the walls or ceilings separating the *dwelling* from the shared accessory room shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other *approved* material and shall not have openings into the shared accessory room.

[W] R302.3.5.3 Other penetrations. Penetrations through the walls, ceiling, and floor level separation required in Section R302.3.5 shall be protected as required by Section R302.11, Item 4.

TABLE R302.3.5
DWELLING-SHARED ACCESSORY ROOM SEPARATION

SEPARATION	MATERIAL
From the dwelling units and attics	Not less than 1/2-inch gypsum board or equivalent applied to the accessory room side wall.
From habitable rooms above or below the shared accessory room.	Not less than 5/8-inch Type X gypsum board or equivalent.
Structures supporting floor/ceiling assemblies used for separation required by this section.	Not less than 1/2-inch gypsum board or equivalent.

R302.4 Dwelling unit rated penetrations. Penetrations of wall or floor-ceiling assemblies required to be fire-resistance rated in accordance with Section R302.2 or R302.3 shall be protected in accordance with this section.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exceptions:

1. Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:
    1.1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:
        1.1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
        1.1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm^2).
    1.2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
2. The annular space created by the penetration of water-filled fire sprinkler piping, provided that the annular space is filled using a material complying with Item 1.2 of Exception 1.

R302.4.1.1 Fire-resistance-rated assembly. Penetrations shall be installed as tested in the *approved* fire-resistance-rated assembly.

R302.4.1.2 Penetration firestop system. Penetrations shall be protected by an *approved* penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479, with a positive pressure differential of not less than 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor-ceiling assembly penetrated.

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m^2) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet (9.29 m^2) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
    1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
    1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
    1.3. By solid fireblocking in accordance with Section R302.11.
    1.4. By protecting both boxes with *listed* putty pads.
    1.5. By other *listed* materials and methods.
2. Membrane penetrations by *listed* electrical boxes of any materials provided that the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the *listing*. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm) unless *listed* otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:

R302.11.1 Fireblocking materials. Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25.4 mm) nominal lumber with broken lap joints.
3. One thickness of 23/32-inch (18.3 mm) *wood structural panels* with joints backed by 23/32-inch (18.3 mm) *wood structural panels*.
4. One thickness of 3/4-inch (19.1 mm) particleboard with joints backed by 3/4-inch (19.1 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-quarter-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other *approved* materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested in accordance with ASTM E119 or UL 263, for the specific application.

R302.11.1.1 Batts or blankets of mineral or glass fiber. Batts or blankets of mineral or glass fiber or other *approved* nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

R302.11.1.2 Unfaced fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a height of not less than 16 inches (406 mm) measured vertically. Where piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

R302.11.1.3 Loose-fill insulation material. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

R302.11.2 Fireblocking integrity. The integrity of fireblocks shall be maintained.

R302.12 Draftstopping. In combustible construction where there is usable space both above and below the concealed space of a floor-ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m^2). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor-ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

R302.12.1 Materials. Draftstopping materials shall be not less than 1/2-inch (12.7 mm) gypsum board, 3/8-inch (9.5 mm) *wood structural panels* or other *approved* materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise *approved* by the *building official*. The integrity of the draftstops shall be maintained.

[W] R302.13 Fire protection of floors. Floor assemblies that are not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) *wood structural panel* membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with ((~~Section P2904~~)) Appendix U, NFPA 13D, or other *approved* equivalent sprinkler system.
2. Floor assemblies located directly over a *crawl space* not intended for storage or ((~~for the installation of~~)) fuel-fired ((~~or electric-powered heating~~)) *appliances*.
3. Portions of floor assemblies shall be permitted to be unprotected where complying with the following:
   3.1. The aggregate area of the unprotected portions does not exceed 80 square feet (7.4 m^2) per story.
   3.2. Fireblocking in accordance with Section R302.11.1 is installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or *structural composite lumber* with a cross sectional area equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other *approved* floor assemblies demonstrating equivalent fire performance.

[S] R302.14 Combustible insulation clearance. Combustible insulation shall be separated not less than 3 inches (76 mm) from recessed luminaires, fan motors and other heat-producing devices.

Exception: Where heat-producing devices are *listed* for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed luminaires installed in the *building thermal envelope* shall meet the requirements of ((~~Section N1102.4.5 of this code~~)) the *Seattle Energy Code*.

SECTION R303
LIGHT, VENTILATION AND HEATING

[W] R303.1 ((~~Habitable rooms~~)) Natural light. ((~~Habitable~~)) All habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms. ((~~Natural *ventilation* shall be through windows, skylights, doors, louvers or other *approved* openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The openable area to the outdoors shall be not less than 4 percent of the floor area being ventilated.~~))

Exceptions:

((~~1. For habitable rooms other than kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical *ventilation* system or a mechanical ventilation system capable of producing 0.35 air changes per hour in the habitable rooms is installed in accordance with Section M1505.~~

~~2. For kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a local exhaust system is installed in accordance with Section M1505.~~

~~3~~)) 1. The glazed areas need not be installed in rooms where ((~~Exception 1 is satisfied~~)) and artificial light is provided that is capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

((~~4. Use of *sunroom* and patio covers, as defined in Section R202, shall be permitted for natural *ventilation* if in excess of 40 percent of the exterior *sunroom* walls are open, or are enclosed only by insect screening.~~))

[W] R303.2 Adjoining rooms. For the purpose of determining light ((~~and *ventilation*~~)) requirements, ((~~rooms~~)) any room shall be considered to be a portion of an adjoining room where not less than one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room and not less than 25 square feet (2.3 m^2).

Exception: Openings required for light ((~~or *ventilation*~~)) shall be permitted to open into a *sunroom* with thermal isolation or a patio cover, provided that there is an openable area between the adjoining room and the *sunroom* or patio cover of not less than one-tenth of the floor area of the interior room and not less than 20 square feet (2 m^2). ((~~The minimum openable area to the outdoors shall be based on the total floor area being ventilated.~~))

[W] R303.3 Bathrooms. ((~~Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.3 m^2), one half of which shall be openable.~~)) This section is not adopted.

((~~**Exception:** The glazed areas shall not be required where artificial light and a local exhaust system are provided. The minimum local exhaust rates shall be determined in accordance with Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors.~~))

((~~**R303.4 Mechanical ventilation.** Buildings and *dwelling units* complying with Section N1102.4.1 shall be provided with mechanical ventilation in accordance with Section M1505, or with other *approved* means of ventilation.~~))

[W] R303.4 Minimum ventilation performance. *Dwelling units* shall be equipped with *local exhaust* and *whole house ventilation systems* designed and installed as specified in Section M1505.4.

Exception: Additions with less than 500 square feet of conditioned floor area are exempt from the requirements for *whole house mechanical ventilation systems*.

((~~**R303.5 Opening location.** Outdoor intake and exhaust openings shall be located in accordance with Sections R303.5.1 and R303.5.2.~~

~~**R303.5.1**~~)) **R303.5 Intake openings.** Mechanical and gravity outdoor air intake openings shall be located ((~~not less than~~)) a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code.

For the purpose of this section, the exhaust from *dwelling unit* toilet rooms, bathrooms and *kitchens* shall not be considered as hazardous or noxious.

Exceptions:

1. The 10-foot (3048 mm) separation is not required where the intake opening is located 3 feet (914 mm) or greater below the contaminant source.
2. Vents and chimneys serving fuel-burning *appliances* shall be terminated in accordance with the applicable provisions of Chapters 18 and 24.
3. Clothes dryer exhaust ducts shall be terminated in accordance with Section M1502.3.

((~~R303.5.2~~)) R303.5.1 Exhaust openings. Exhaust air shall not be directed onto walkways. All exhaust ducts shall terminate outside the building. Terminal elements shall have at least the equivalent net free area of the ductwork.

R303.5.1.1 Exhaust ducts. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

R303.6 Outside opening protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having an opening size of not less than 1/4 inch (6 mm) and a maximum opening size of 1/2 inch (13 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with this code.

[W] R303.7 Interior stairway illumination. Interior *stairways* shall be provided with an artificial light source to illuminate the landings and treads. Stairway illumination shall receive power from the building wiring. The light source shall be capable of illuminating treads and landings to levels of not less than 1 footcandle (11 lux) as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the *stairway* has six or more *risers*.

Exception: A switch is not required where remote, central or automatic control of lighting is provided.

[W] R303.8 Exterior stairway illumination. Exterior *stairways* shall be provided with an artificial light source located at the top landing of the *stairway*. Stairway illumination shall receive power from the building wiring. Exterior *stairways* providing access to a *basement* from the outdoor *grade* level shall be provided with an artificial light source located at the bottom landing of the *stairway*.

[W] R303.9 Required glazed openings. Required glazed openings shall open directly onto a street or public alley, or a *yard* or court located on the same *lot* as the building.

Exceptions:

1. Required glazed openings that face into a roofed porch where the porch abuts a street, *yard* or court ((~~and~~)) are permitted where the longer side of the porch is not less than 65 percent unobstructed and the ceiling height is not less than 7 feet (2134 mm).
2. Eave projections shall not be considered as obstructing the clear open space of a *yard* or court.
3. Required glazed openings that face into the area under a deck, balcony, bay or floor cantilever are permitted where ((~~a clear vertical space not less than 36 inches (914 mm) in height~~)) an unobstructed pathway of not less than 36 inches (914 mm) in height, 36 inches (914 mm) in width, and no greater than 60 inches (1524 mm) in length is provided and opens to a yard or court. The pathway shall be measured from the exterior face of the glazed opening, or if the glazed opening is in a window well, at the window well wall furthest from the exterior face of the glazed opening.

R303.9.1 Sunroom additions. Required glazed openings shall be permitted to open into *sunroom additions* or patio covers that abut a street, *yard* or court if in excess of 40 percent of the exterior *sunroom* walls are open, or are enclosed only by insect screening, and the ceiling height of the *sunroom* is not less than 7 feet (2134 mm).

[W][S] R303.10 Required heating. ((~~Where the winter design temperature in Table R301.2 is below 60°F (16°C), every~~)) Every *dwelling unit* shall be provided with heating facilities capable of maintaining a minimum room temperature of ((~~not less than~~)) 68°F (20°C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in habitable rooms, baths and toilet rooms at the design temperature as specified in Table R301.2. The installation of one or more portable space heaters shall not be used to achieve compliance with this section.

Exception: Unheated recreational tents or yurts not exceeding 500 square feet provided they are not occupied as a permanent dwelling.

Interpretation R303.10: Accessory *dwelling units* shall be provided with heating controls separate from the primary *dwelling unit*.

[W] R303.10.1 Definitions. For the purposes of this section only, the following definitions apply:

DESIGNATED AREAS are those areas designated by a county to be an urban growth area in chapter 36.70A RCW and those areas designated by the U.S. Environmental Protection Agency as being in nonattainment for particulate matter.

SUBSTANTIALLY REMODELED means any *alteration* or restoration of a building exceeding 60 percent of the appraised value of such building within a 12-month period. For the purpose of this section, the appraised value is the estimated cost to replace the building and structure in kind, based on current replacement costs.

[W] R303.10.2 Primary heating source. Primary heating sources in all new and substantially remodeled buildings in designated areas shall not be dependent upon wood stoves.

[W] R303.10.3 Solid fuel burning devices. No new or used solid fuel burning device shall be installed in new or existing buildings unless such device is U.S. Environmental Protection Agency certified or exempt from certification by the United States Environmental Protection Agency and conforms with RCW 70A.15.1005, 70A.15.3500, 70A.15.3510, and 70A.15.3530.

Exceptions:

1. Wood cook stoves.
2. Antique wood heaters manufactured prior to 1940.

SECTION R304
MINIMUM ROOM AREAS

R304.1 Minimum area. Habitable rooms shall have a floor area of not less than 70 square feet (6.5 m^2).

Exception: Kitchens.

R304.2 Minimum dimensions. Habitable rooms shall be not less than 7 feet (2134 mm) in any horizontal dimension.

Exception: Kitchens.

R304.3 Height effect on room area. Portions of a room with a sloping ceiling measuring less than 5 feet (1524 mm) or a furred ceiling measuring less than 7 feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

SECTION R305
CEILING HEIGHT

R305.1 Minimum height. *Habitable space*, hallways and portions of *basements* containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exceptions:

1. For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet (1524 mm) and not less than 50 percent of the required floor area shall have a ceiling height of not less than 7 feet (2134 mm).
2. The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a ceiling height of not less than 6 feet 8 inches (2032 mm) above an area of not less than 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.
3. Beams, girders, ducts or other obstructions in *basements* containing *habitable space* shall be permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor.
4. Beams and girders spaced apart not less than 36 inches (914 mm) in clear finished width shall project not more than 78 inches (1981 mm) from the finished floor.

R305.1.1 Basements. Portions of *basements* that do not contain *habitable space* or hallways shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exception: At beams, girders, ducts or other obstructions, the ceiling height shall be not less than 6 feet 4 inches (1931 mm) from the finished floor.

SECTION R306
SANITATION

R306.1 Toilet facilities. Every *dwelling unit* shall be provided with a water closet, lavatory, and a bathtub or shower.

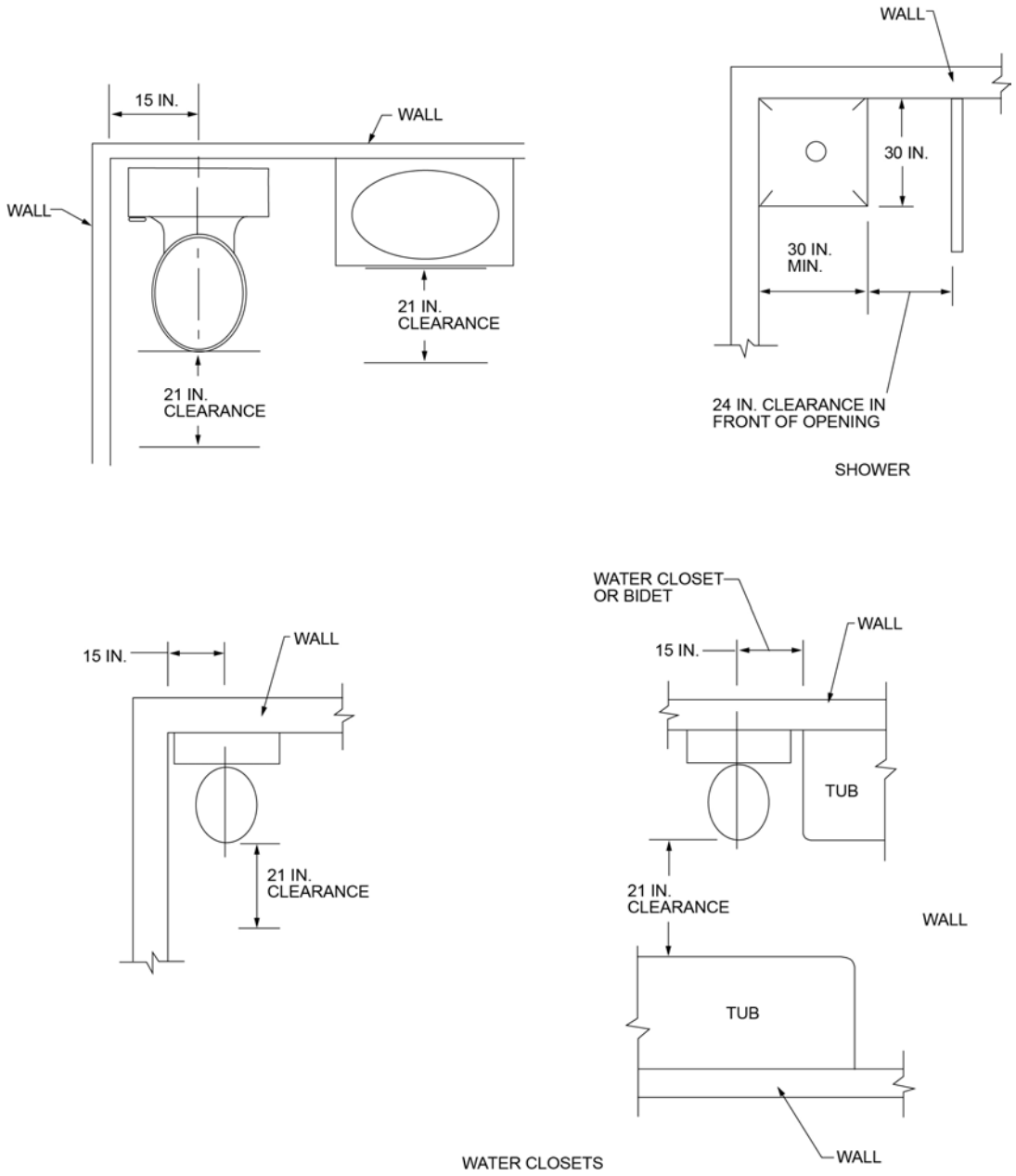
R306.2 Kitchen. Each *dwelling unit* shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

R306.3 Sewage disposal. Plumbing fixtures shall be connected to a sanitary sewer or to an *approved* private sewage disposal system.

R306.4 Water supply to fixtures. Plumbing fixtures shall be connected to an *approved* water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water.

SECTION R307
TOILET, BATH AND SHOWER SPACES

[W] R307.1 Space required. Fixtures shall be spaced in accordance with Figure R307.1, and in accordance with the requirements of ((~~Section P2705.1~~)) the state plumbing code Section 402.5.



For SI: 1 inch = 25.4 mm.

FIGURE R307.1
MINIMUM FIXTURE CLEARANCES

R309.2 Carports. Carports shall be open on not less than two sides. Carport floor surfaces shall be of *approved noncombustible material*. Carports not open on two or more sides shall be considered to be a garage and shall comply with the provisions of this section for garages.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

Exception: Asphalt surfaces shall be permitted at ground level in carports.

R309.3 Flood hazard areas. Garages and carports located in flood hazard areas as established by Table R301.2 shall be constructed in accordance with Section R322.

R309.4 Automatic garage door openers. Automatic garage door openers, if provided, shall be *listed* and *labeled* in accordance with UL 325.

[S] ((~~R309.5 Fire sprinklers.~~ ~~Private garages shall be protected by fire sprinklers where the garage wall has been designed based on Table R302.1(2), Note a. Sprinklers in garages shall be connected to an automatic sprinkler system that complies with Section P2904. Garage sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a density of 0.05 gpm/ft^2. Garage doors shall not be considered obstructions with respect to sprinkler placement.~~))

[W] R309.5 Electric vehicle charging.

R309.5.1 Application. The provisions of this section shall apply to the construction of new dwelling units per Section R101.2 with attached private garages or attached private carports.

Exception: Where there is no public utility or commercial power supply.

R309.5.2 Dedicated circuit for electric vehicle charging. A minimum of one 40-ampere dedicated 208/240-volt branch circuit shall be installed in the electrical panel for each dwelling unit.

The branch circuit shall terminate at a junction box, receptacle outlet, or electric vehicle charging equipment.

Note: Installation of electric vehicle charging infrastructure is subject to additional requirements found in the *Seattle Electrical Code* and *Seattle Land Use Code*.

SECTION R310
EMERGENCY ESCAPE AND RESCUE OPENINGS

[W] R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable *emergency escape and rescue opening*. Where *basements* contain one or more sleeping rooms, an *emergency escape and rescue opening* shall be required in each sleeping room. *Emergency escape and rescue openings* shall open directly into a *public way*, or to a *yard* or court ((~~having a minimum width of 36 inches (914 mm)~~)) providing an unobstructed path with a width of not less than 36 inches (914 mm) that opens to a *public way*.

Exceptions:

1. *Storm shelters* and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m^2).
2. Where the *dwelling unit* or *townhouse unit* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in *basements* shall not be required to have *emergency escape and rescue openings* provided that the *basement* has one of the following:
   2.1. One means of egress complying with Section R311 and one *emergency escape and rescue opening*.
   2.2. Two means of egress complying with Section R311.
3. A *yard* shall not be required to open directly into a *public way* where the *yard* opens to an unobstructed path from the *yard* to the *public way*. Such path shall have a width of not less than 36 inches (914 mm). The following shall not be considered obstructions:
   3.1. Gates with operational constraints and opening control devices without the use of keys, tools, or special knowledge.
   3.2. Window wells equipped with a removable cover complying with Section R310.4.4.

R310.1.1 Operational constraints and opening control devices. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required *emergency escape and rescue opening* and shall be not more than 70 inches (178 cm) above the finished floor.

R310.2 Emergency escape and rescue openings. *Emergency escape and rescue openings* shall have minimum dimensions in accordance with Sections R310.2.1 through R310.2.4.

R310.2.1 Minimum size. *Emergency escape and rescue openings* shall have a net clear opening of not less than 5.7 square feet (0.530 m^2).

Exception: The minimum net clear opening for *grade-floor emergency escape and rescue openings* shall be 5 square feet (0.465 m^2).

R310.2.2 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

R310.2.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) above the floor.

[W] R310.2.4 Emergency escape and rescue openings under decks, porches and cantilevers. *Emergency escape and rescue openings* installed under decks, porches and cantilevers shall be fully openable and ((~~provide a path~~)) provided with an unobstructed pathway not less than 36 inches (914 mm) in height, ((~~and~~)) 36 inches (914 mm) in width, and no greater than 60 inches (1524 mm) in length that opens to a *yard* or court. The pathway shall be measured from the exterior face of the glazed opening, or if the glazed opening is in a window well, at the window well wall furthest from the exterior face of the glazed opening.

R310.3 Emergency escape and rescue doors. Where a door is provided as the required *emergency escape and rescue opening*, it shall be a side-hinged door or a sliding door.

R310.4 Area wells. An *emergency escape and rescue opening* where the bottom of the clear opening is below the adjacent grade shall be provided with an area well in accordance with Sections R310.4.1 through R310.4.4.

R310.4.1 Minimum size. The horizontal area of the area well shall be not less than 9 square feet (0.9 m^2), with a horizontal projection and width of not less than 36 inches (914 mm). The size of the area well shall allow the *emergency escape and rescue opening* to be fully opened.

Exception: The ladder or steps required by Section R310.4.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

R310.4.2 Ladder and steps. Area wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with an *approved*, permanently affixed ladder or steps. The ladder or steps shall not be obstructed by the *emergency escape and rescue opening* where the window or door is in the open position. Ladders or steps required by this section shall not be required to comply with Section R311.7.

R310.4.2.1 Ladders. Ladders and rungs shall have an inside width of not less than 12 inches (305 mm), shall project not less than 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the area well.

R310.4.2.2 Steps. Steps shall have an inside width of not less than 12 inches (305 mm), a minimum tread depth of 5 inches (127 mm) and a maximum *riser* height of 18 inches (457 mm) for the full height of the area well.

R310.4.3 Drainage. Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1.

Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.4.4 Bars, grilles, covers and screens. Where bars, grilles, covers, screens or similar devices are placed over *emergency escape and rescue openings*, bulkhead enclosures or area wells that serve such openings, the minimum net clear opening size shall comply with Sections R310.2 through R310.2.2 and R310.4.1. Such devices shall be releasable or removable from the inside without the use of a key or tool or force greater than that required for the normal operation of the escape and rescue opening.

[W] R310.5 Replacement windows for emergency escape and rescue openings. ((~~Replacement windows installed in buildings meeting the scope of this code shall be exempt from Sections R310.2 and R310.4.4, provided that the replacement window meets the following conditions:~~)) This section is not adopted.

((~~1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window is of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.~~

~~2. The replacement window is not part of a change of occupancy.~~))

((~~R310.6~~)) R310.5 Dwelling additions. Where *dwelling additions* contain sleeping rooms, an *emergency escape and rescue opening* shall be provided in each new sleeping room. Where *dwelling additions* have *basements*, an *emergency escape and rescue opening* shall be provided in the new *basement*.

Exceptions:

1. An *emergency escape and rescue opening* is not required in a new *basement* that contains a sleeping room with an *emergency escape and rescue opening*.
2. An *emergency escape and rescue opening* is not required in a new *basement* where there is an *emergency escape and rescue opening* in an existing *basement* that is *accessed* from the new *basement*.
3. An operable window complying with Section 310.7.1 shall be acceptable as an *emergency escape and rescue opening*.

((~~R310.7~~)) R310.6 Alterations or repairs of existing basements. New sleeping rooms created in an existing *basement* shall be provided with *emergency escape and rescue openings* in accordance with Section R310.1. Other than new sleeping rooms, where existing basements undergo alterations or repairs, an *emergency escape and rescue opening* is not required.

Exception: An operable window complying with Section 310.7.1 shall be acceptable as an *emergency escape and rescue opening*.

((~~R310.7.1~~)) R310.6.1 Existing emergency escape and rescue openings. Where a *change of occupancy* would require an *emergency escape and rescue opening* in accordance with Section 310.1, operable windows serving as the *emergency escape and rescue opening* shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
   2.1. The replacement window meets the size requirements in Item 1.
   2.2. The replacement window is the manufacturer's largest standard-size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

SECTION R311
MEANS OF EGRESS

R311.1 Means of egress. *Dwellings* shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* to the required egress door without requiring travel through a garage. The required egress door shall open directly into a *public way* or to a *yard* or court that opens to a *public way*.

R311.2 Egress door. Not less than one egress door shall be provided for each *dwelling unit*. The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches (813 mm) where measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). The clear height of the door opening shall be not less than 78 inches (1981 mm) in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the *dwelling* without the use of a key or special knowledge or effort.

R311.3 Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall be not less than the door served. Landings shall have a dimension of not less than 36 inches (914 mm) measured in the direction of travel. The slope at exterior landings shall not exceed 1/4 unit vertical in 12 units horizontal (2 percent).

Exception: Exterior balconies less than 60 square feet (5.6 m^2) and only *accessed* from a door are permitted to have a landing that is less than 36 inches (914 mm) measured in the direction of travel.

R311.3.1 Floor elevations at the required egress doors. Landings or finished floors at the required egress door shall be not more than 1-1/2 inches (38 mm) lower than the top of the threshold.

Exception: The landing or floor on the exterior side shall be not more than 7-3/4 inches (196 mm) below the top of the threshold provided that the door does not swing over the landing or floor.

Where exterior landings or floors serving the required egress door are not at *grade*, they shall be provided with access to *grade* by means of a *ramp* in accordance with Section R311.8 or a *stairway* in accordance with Section R311.7.

R311.3.2 Floor elevations at other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than 7-3/4 inches (196 mm) below the top of the threshold.

Exception: A top landing is not required where a *stairway* of not more than two *risers* is located on the exterior side of the door, provided that the door does not swing over the *stairway*.

R311.3.3 Storm and screen doors. Storm and screen doors shall be permitted to swing over exterior stairs and landings.

[W] R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* that are not provided with an egress door in accordance with Section R311.2 shall be by a *ramp* in accordance with Section R311.8 or a *stairway* in accordance with Section R311.7.

Exception: Stairways, alternating tread devices, ship's ladders or ladders within an individual *dwelling unit* or sleeping unit used for access to areas of 200 square feet (18.6 m^2) or less, are exempt from the requirements of Sections R311.4 and R311.7, where such devices do not provide exclusive access to a kitchen or bathroom. Such areas shall not be located more than 10 feet (3048 mm) above the finished floor of the space below.

R311.5 Landing, deck, balcony and stair construction and attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

R311.6 Hallways. The width of a hallway shall be not less than 3 feet (914 mm).

R311.7 Stairways. Where required by this code or provided, *stairways* shall comply with this section.

Exceptions:

1. Stairways not within or serving a building, porch or deck.
2. Stairways leading to nonhabitable attics.
3. Stairways leading to *crawl spaces*.

R311.7.1 Width. *Stairways* shall be not less than 36 inches (914 mm) in clear width at all points above the permitted *handrail* height and below the required headroom height. The clear width of *stairways* at and below the *handrail* height, including treads and landings, shall be not less than 31-1/2 inches (787 mm) where a *handrail* is installed on one side and 27 inches (698 mm) where *handrails* are installed on both sides.

Exception: The width of *spiral stairways* shall be in accordance with Section R311.7.10.1.

R311.7.2 Headroom. The headroom in *stairways* shall be not less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread *nosing* or from the floor surface of the landing or platform on that portion of the *stairway*.

Exceptions:

1. Where the *nosings* of treads at the side of a flight extend under the edge of a floor opening through which the *stair* passes, the floor opening shall not project horizontally into the required headroom more than 4-3/4 inches (121 mm).
2. The headroom for spiral *stairways* shall be in accordance with Section R311.7.10.1.

R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet 7 inches (3835 mm) between floor levels or landings.

R311.7.4 Walkline. The walkline across *winder* treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where *winders* are adjacent within a flight, the point of the widest clear stair width of the adjacent *winders* shall be used.

R311.7.5 Stair treads and risers. *Stair* treads and *risers* shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.5.1 Risers. The *riser* height shall be not more than 7-3/4 inches (196 mm). The *riser* height shall be measured vertically between leading edges of the adjacent treads. The greatest *riser* height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). *Risers* shall be vertical or sloped from the underside of the *nosing* of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open *risers*, openings located more than 30 inches (762 mm), as measured vertically, to the floor or *grade* below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on *spiral stairways*.
2. The *riser* height of *spiral stairways* shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

R311.8.1 Maximum slope. *Ramps* serving the egress door required by Section R311.2 shall have a slope of not more than 1 unit vertical in 12 units horizontal (8.3-percent slope).

Other *ramps* shall have a slope of not more than 1 unit vertical in 8 units horizontal (12.5 percent).

Exception: Where it is technically infeasible to comply because of site constraints, *ramps* shall have a slope of not more than 1 unit vertical in 8 units horizontal (12.5 percent).

R311.8.2 Landings required. There shall be a floor or landing at the top and bottom of each *ramp*, where doors open onto *ramps*, and where *ramps* change directions. The width of the landing perpendicular to the *ramp* slope shall be not less than the width of the *ramp*. The depth of the landing in the direction of the ramp slope shall be not less than 36 inches (914 mm).

R311.8.3 Handrails required. *Handrails* shall be provided on not less than one side of *ramps* exceeding a slope of 1 unit vertical in 12 units horizontal (8.33-percent slope).

R311.8.3.1 Height. *Handrail* height, measured above the finished surface of the *ramp* slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

R311.8.3.2 Grip size. *Handrails* on *ramps* shall comply with Section R311.7.8.5.

R311.8.3.3 Continuity. *Handrails* where required on *ramps* shall be continuous for the full length of the *ramp*. *Handrail* ends shall be returned or shall terminate in newel posts or safety terminals. *Handrails* adjacent to a wall shall have a space of not less than 1-1/2 inches (38 mm) between the wall and the *handrails*.

SECTION R312
GUARDS AND WINDOW FALL PROTECTION

R312.1 Guards. *Guards* shall be provided in accordance with Sections R312.1.1 through R312.1.4.

[W] R312.1.1 Where required. *Guards* shall be provided for those portions of open-sided walking surfaces, including ((~~floors,~~)) mezzanines, lofts in accordance with Section R333, stairs, *ramps* and landings that are located more than 30 inches (762 mm) measured vertically to the floor or *grade* below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a *guard*.

[W] R312.1.2 Height. Required *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) in height as measured vertically above the adjacent walking surface or the line connecting the *nosings*.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the *nosings*.
2. Where the top of the *guard* serves as a *handrail* on the open sides of stairs, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the *nosings*.
3. In areas with ceiling heights of 7 feet (2134 mm) or less in *lofts* constructed in accordance with Section R333, *guards* shall not be less than 36 inches (914 mm) in height or one-half of the clear height from the *loft* floor to the *loft* ceiling, whichever is less.

R312.1.3 Opening limitations. Required *guards* shall not have openings from the walking surface to the required *guard* height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of *stair*, formed by the *riser*, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open side of stairs shall not have openings that allow passage of a sphere 4-3/8 inches (111 mm) in diameter.

R312.1.4 Exterior plastic composite guards. *Plastic composite* exterior *guards* shall comply with the requirements of Section R317.4.

R312.2 Window fall protection. Window fall protection shall be provided in accordance with Sections R312.2.1 and R312.2.2.

R312.2.1 Window opening height. In *dwelling units*, where the bottom of the clear opening of an operable window opening is located less than 24 inches (610 mm) above the finished floor and greater than 72 inches (1829 mm) above the finished *grade* or other surface below on the exterior of the building, the operable window shall comply with one of the following:

1. Operable window openings will not allow a 4-inch-diameter (102 mm) sphere to pass through where the openings are in their largest opened position.
2. Operable windows are provided with window opening control devices or fall prevention devices that comply with ASTM F2090.

R312.2.2 Emergency escape and rescue openings. Where an operable window serves as an *emergency escape and rescue opening*, a window opening control device or fall prevention device, after operation to release the control device or fall prevention device allowing the window to fully open, shall not reduce the net clear opening area of the window unit to less than the area required by Sections R310.2.1 and R310.2.2.

SECTION R313
AUTOMATIC FIRE SPRINKLER SYSTEMS

[W][S] R313.1 Townhouse automatic fire sprinkler systems. An automatic sprinkler system shall be installed in ((~~*townhouses*~~)) a *townhouse unit*.

Exception: An automatic residential fire sprinkler system shall not be required where *additions* or *alterations* are made to an existing ((~~*townhouses*~~)) *townhouse unit* that does not have an automatic sprinkler system installed.

R313.1.1 Design and installation. Automatic residential sprinkler systems for ((~~*townhouses*~~)) a *townhouse unit* shall be designed and installed in accordance with Section P2904 or NFPA 13D.

[W] ((~~R313.2 One- and two-family dwellings automatic sprinkler systems.~~ ~~An automatic sprinkler system shall be installed in one- and two-family *dwellings*.~~

~~**Exception:** An automatic sprinkler system shall not be required for *additions* or *alterations* to existing buildings that are not already provided with a sprinkler system.~~

~~**R313.2.1 Design and installation.** Automatic sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.~~))

SECTION R314
SMOKE ALARMS

[W] R314.1 General. Smoke alarms, heat detectors, and heat alarms shall comply with NFPA 72 and ((~~Section R314~~)) this section.

R314.1.1 Listings. Smoke alarms shall be *listed* in accordance with UL 217. Heat detectors and heat alarms shall be listed for the intended application. Combination smoke and carbon monoxide alarms shall be *listed* in accordance with UL 217 and UL 2034.

[W] R314.2 Where required. Smoke alarms, heat detectors, and heat alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in *dwelling units*. A heat detector or heat alarm shall be provided in new attached garages.

R314.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a *permit* occur, or where one or more sleeping rooms are added or created in existing dwellings, or where an accessory dwelling unit is created within an existing dwelling unit, ((~~the individual~~)) each *dwelling unit* shall be equipped with smoke alarms ((~~located~~)) as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of a porch or deck, is exempt from the requirements of this section.
2. Installation, *alteration* or repairs of plumbing, electrical or mechanical systems are exempt from the requirements from this section.

R314.2.3 New attached garages. A heat detector or heat alarm rated for the ambient outdoor temperatures and humidity shall be installed in new garages that are attached to or located under new and existing dwellings. Heat detectors and heat alarms shall be installed in a central location and in accordance with the manufacturer's instructions.

Exception: Heat detectors and heat alarms shall not be required in dwellings without commercial power.

[W] R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.

2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the *dwelling*, including *basements* and *habitable attics* and not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.
4. ((~~Not~~)) Smoke alarms shall be installed not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by ((~~this section~~)) Section R314.3.
5. In napping areas in *family home child care*.

((~~5~~)) 6. In the hallway and in the room open to the hallway in *dwelling units* where the ceiling height of a room open to a hallway serving bedrooms exceeds that of the hallway by 24 inches (610 mm) or more.

7. Within the room to which a loft is open, immediate vicinity of the loft.

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Smoke alarms *listed* and marked "helps reduce cooking nuisance alarms" shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.

[W] R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual *dwelling unit* in accordance with Section ((~~R314.3~~)) R314.2, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual *dwelling unit*. Where an accessory dwelling unit is created within an existing dwelling unit all required smoke alarms, in the accessory dwelling unit and the primary dwelling unit, shall be interconnected in such a manner that the actuation of one alarm will activate all alarms in both the primary dwelling unit and the accessory dwelling unit. Physical interconnection of smoke alarms shall not be required where *listed* wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Smoke alarms and alarms installed to satisfy Section R314.4.1 shall not be required to be interconnected to existing smoke alarms where such existing smoke alarms are not interconnected or where such new smoke alarm or alarm is not capable of being interconnected to the existing smoke alarms.

R314.4.1 Heat detection interconnection. Heat detectors and heat alarms shall be connected to an alarm or a smoke alarm that is installed in the dwelling. Alarms and smoke alarms that are installed for this purpose shall be located in a hallway, room, or other location that will provide occupant notification.

R314.5 Combination alarms. Combination smoke and carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms.

[W] R314.6 Power source. Smoke alarms, heat alarms, and heat detectors shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning equipment provisions of NFPA 72. Smoke detectors shall be *listed* in accordance with UL 268.

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner.

R314.7.4 Combination detectors. Combination smoke and carbon monoxide detectors shall be permitted to be installed in fire alarm systems in lieu of smoke detectors, provided that they are *listed* in accordance with UL 268 and UL 2075.

SECTION R315
CARBON MONOXIDE ALARMS

R315.1 General. Carbon monoxide alarms shall comply with Section R315.

R315.1.1 Listings. Carbon monoxide alarms shall be *listed* in accordance with UL 2034. Combination carbon monoxide and smoke alarms shall be *listed* in accordance with UL 217 and UL 2034.

[W] R315.2 Where required. Carbon monoxide alarms shall be provided in accordance with Sections R315.2.1 and R315.2.2.

R315.2.1 New construction. For new construction, an *approved* carbon monoxide ((~~alarms~~)) alarm shall be ((~~provided in *dwelling units* where either or both of the following conditions exist~~)) installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in *dwelling units* and on each level of the dwelling in accordance with the manufacturer's recommendation.

((~~1. The *dwelling unit* contains a fuel-fired *appliance*.~~

~~2. The *dwelling unit* has an attached garage with an opening that communicates with the *dwelling unit*.~~))

R315.2.2 Alterations, repairs and additions. ((~~Where *alterations*, *repairs* or *additions* requiring a *permit* occur, the individual *dwelling unit* shall be equipped with carbon monoxide alarms located as required for new *dwellings*.~~)) Existing dwellings shall be equipped with carbon monoxide alarms in accordance with Section R315.2.1. An inspection will occur where *alterations*, repairs, or additions requiring a permit occur, or where one or more sleeping rooms are added or created.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, is exempt from the inspection requirements of this section.
2. Installation, *alteration* or repairs of non-fuel-burning plumbing, electrical systems are exempt from the requirements of this section.
3. Installation, alteration or repairs of mechanical systems that are not fuel fired.
4. Owner-occupied single-family residences legally occupied before July 26, 2009. See RCW 19.27.530(2)(b).

[W] R315.3 Location. Carbon monoxide alarms in *dwelling units* shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms and on each level of the *dwelling* and in accordance with the manufacturer's recommendations. Where a fuel-burning *appliance* is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

R315.4 Combination alarms. Combination carbon monoxide and smoke alarms shall be permitted to be used in lieu of carbon monoxide alarms.

R315.5 Interconnectivity. Where more than one carbon monoxide alarm is required to be installed within an individual *dwelling unit* in accordance with Section R315.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual *dwelling unit*. Physical interconnection of carbon monoxide alarms shall not be required where *listed* wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of carbon monoxide alarms in existing areas shall not be required where *alterations* or *repairs* do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, *crawl space* or *basement* available that could provide access for interconnection without the removal of interior finishes.

R315.6 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

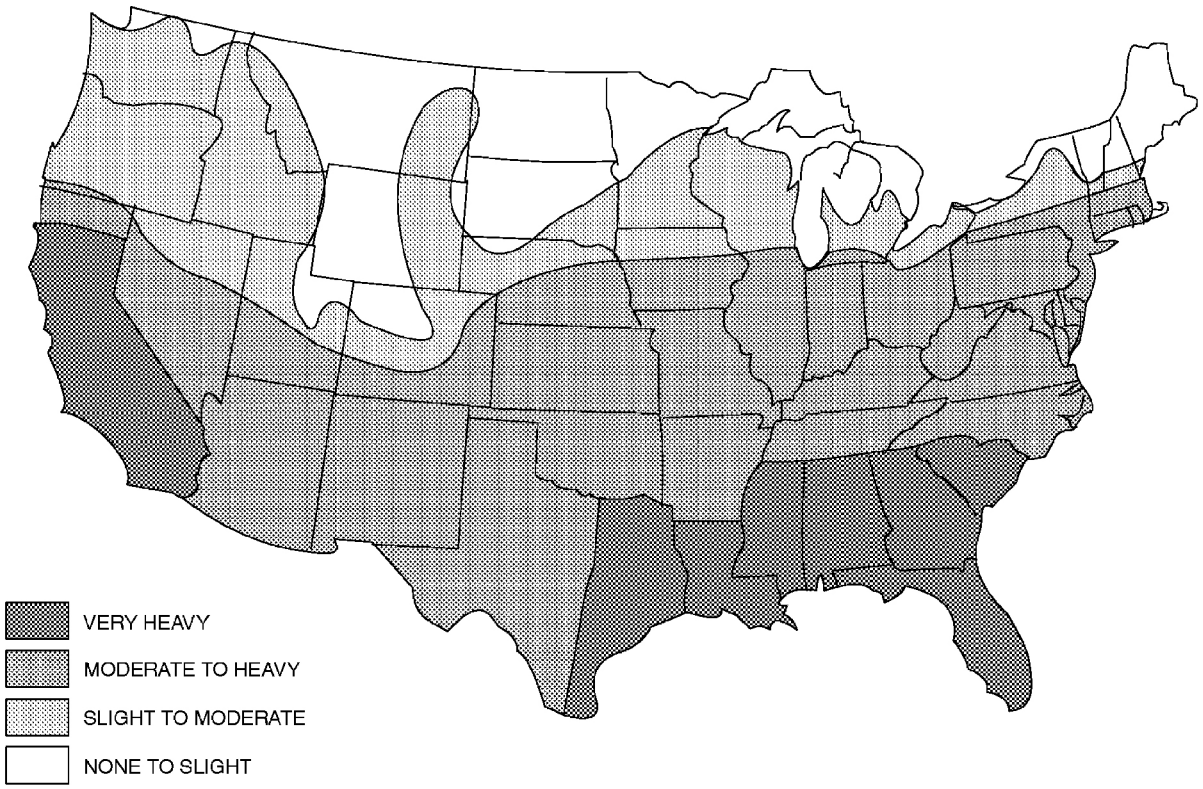
Exceptions:

1. Carbon monoxide alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Carbon monoxide alarms installed in accordance with Section R315.2.2 shall be permitted to be battery powered.

R315.7 Carbon monoxide detection systems. Carbon monoxide detection systems shall be permitted to be used in lieu of carbon monoxide alarms and shall comply with Sections R315.7.1 through R315.7.4.

R315.7.1 General. Household carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be *listed* in accordance with UL 2075.

R315.7.2 Location. Carbon monoxide detectors shall be installed in the locations specified in Section R315.3. These locations supersede the locations specified in NFPA 720.



Note: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE R318.4
TERMITE INFESTATION PROBABILITY MAP

SECTION R319
SITE ADDRESS

R319.1 Address identification. Buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) in height with a stroke width of not less than 0.5 inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

Premises shall be identified in accordance with *International Building Code* Section 501.2.

SECTION R320
ACCESSIBILITY

R320.1 Scope. Where there are four or more *dwelling units* or *sleeping units* in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply.

Exception: Owner-occupied *lodging houses* with five or fewer guestrooms are not required to be accessible.

R320.2 Live/work units. In *live/work units*, the nonresidential portion shall be accessible in accordance with Sections 508.5.9 and 508.5.11 of the *International Building Code*. In a structure where there are four or more *live/work units*, the dwelling portion of the *live/work unit* shall comply with Section 1108.6.2.1 of the *International Building Code*.

SECTION R321
ELEVATORS AND PLATFORM LIFTS

R321.1 Elevators. Where provided, passenger elevators, limited-use and limited-application elevators or private residence elevators shall comply with ASME A17.1/CSA B44.

R321.2 Platform lifts. Where provided, platform lifts shall comply with ASME A18.1.

R321.3 Accessibility. Elevators or platform lifts that are part of an accessible route required by Chapter 11 of the *International Building Code*, shall comply with ICC A117.1.

SECTION R322
FLOOD-RESISTANT CONSTRUCTION

[S] R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas, including A or V Zones and Coastal A Zones, as established in Table R301.2 and areas of special flood hazard as defined in *Seattle Municipal Code* Section 25.06.030, and substantial improvement and *repair* of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions contained in this section and *Seattle Municipal Code* Chapter 25.06, the Seattle Floodplain Development Ordinance. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.1.1 Alternative provisions. As an alternative to the requirements in Section R322, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R322.1.2 Structural systems. Structural systems of buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation.

R322.1.3 Flood-resistant construction. Buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage.

R322.1.4 Establishing the design flood elevation. The design flood elevation shall be used to define flood hazard areas. At a minimum, the design flood elevation shall be the higher of the following:

1. The base flood elevation at the depth of peak elevation of flooding, including wave height, that has a 1-percent (100-year flood) or greater chance of being equaled or exceeded in any given year.
2. The elevation of the design flood associated with the area designated on a flood hazard map adopted by the community, or otherwise legally designated.

R322.1.4.1 Determination of design flood elevations. If design flood elevations are not specified, the *building official* is authorized to require the applicant to comply with either of the following:

1. Obtain and reasonably use data available from a federal, state or other source.
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a *registered design professional* who shall document that the technical methods used reflect currently accepted engineering practice. Studies, analyses and computations shall be submitted in sufficient detail to allow thorough review and *approval*.

R322.1.4.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall demonstrate that the effect of the proposed buildings and structures on design flood elevations, including fill, when combined with other existing and anticipated flood hazard area encroachments, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the *jurisdiction*.

R322.1.5 Lowest floor. The lowest floor shall be the lowest floor of the lowest enclosed area, including *basement*, and excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, *equipment* and components; heating, ventilating, air-conditioning and plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall meet the requirements of this section. Systems, fixtures, and *equipment* and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Locating electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the required elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the electrical part of this code for wet locations.

[S] R322.1.7 Protection of water supply and sanitary sewage systems. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems in accordance with the plumbing provisions of this code. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with the ((~~plumbing provisions of this code and Chapter 3 of the *International Private Sewage Disposal Code*~~)) *Uniform Plumbing Code*.

R322.1.8 Flood-resistant materials. Building materials and installation methods used for flooring and interior and exterior walls and wall coverings below the elevation required in Section R322.2 or R322.3 shall be flood damage-resistant materials that conform to the provisions of FEMA TB-2.

R322.1.9 Manufactured homes. The bottom of the frame of new and replacement *manufactured homes* on foundations that conform to the requirements of Section R322.2 or R322.3, as applicable, shall be elevated to or above the elevations specified in Section R322.2 (flood hazard areas including A Zones) or R322.3 in coastal high-hazard areas (V Zones and Coastal A Zones). The anchor and tie-down requirements of the applicable state or federal requirements shall apply. The foundation and anchorage of *manufactured homes* to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.1.10 As-built elevation documentation. A *registered design professional* shall prepare and seal documentation of the elevations specified in Section R322.2 or R322.3.

R322.2 Flood hazard areas (including A Zones). Areas that have been determined to be prone to flooding and that are not subject to high-velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1-1/2 feet (457 mm) and 3 feet (914 mm) or otherwise designated by the *jurisdiction* shall be designated as Coastal A Zones and are subject to the requirements of Section R322.3. Buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.4.

[S] R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, not including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, or a greater elevation as designated by the *Seattle Municipal Code*.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. *Basement* floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
4. Garage and carport floors shall comply with one of the following:
    4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
    4.2. They shall be at or above *grade* on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

Exception: Enclosed areas below the elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below required elevation. Enclosed areas, including *crawl spaces*, that are below the elevation required in Section R322.2.1 shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:
    2.1. The total net area of nonengineered openings shall be not less than 1 square inch (645 mm^2) for each square foot (0.093 m^2) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the openings shall be designed as engineered openings and the *construction documents* shall include a statement by a *registered design professional* that the design of the openings will provide for

equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in Section 2.7.2.2 of ASCE 24.

2.2. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.

2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area, each area shall have openings.
2. The bottom of each opening shall be not more than 1 foot (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.
3. Openings shall be permitted to be installed in doors and windows; doors and windows without installed openings do not meet the requirements of this section.

R322.2.3 Foundation design and construction. Foundation walls for buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 4.

Exception: Unless designed in accordance with Section R404:

1. The unsupported height of 6-inch (152 mm) plain masonry walls shall be not more than 3 feet (914 mm).
2. The unsupported height of 8-inch (203 mm) plain masonry walls shall be not more than 4 feet (1219 mm).
3. The unsupported height of 8-inch (203 mm) reinforced masonry walls shall be not more than 8 feet (2438 mm).

For the purpose of this exception, unsupported height is the distance from the finished *grade* of the under-floor space to the top of the wall.

R322.2.4 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.2.1 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood.

R322.3 Coastal high-hazard areas (including V Zones and Coastal A Zones, where designated). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. Flood hazard areas that have been designated as subject to wave heights between 1-1/2 feet (457 mm) and 3 feet (914 mm) or otherwise designated by the *jurisdiction* shall be designated as Coastal A Zones. Buildings and structures constructed in whole or in part in coastal high-hazard areas and Coastal A Zones, where designated, shall be designated and constructed in accordance with Sections R322.3.1 through R322.3.10.

[S] R322.3.1 Location and site preparation.

1. New buildings and buildings that are determined to be substantially improved pursuant to Section ((~~R105.3.1.1~~)) R105.7.3 shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes and mangrove stands, the *building official* shall require submission of an engineering analysis that demonstrates that the proposed alteration will not increase the potential for flood damage.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. *Basement* floors that are below *grade* on all sides are prohibited.
3. Garages used solely for parking, building access or storage, and carports shall comply with Item 1 or shall be at or above *grade* on not less than one side and, if enclosed with walls, such walls shall comply with Item 6.
4. The use of fill for structural support is prohibited.
5. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
6. Walls and partitions enclosing areas below the elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns and shall comply with the following:

R322.3.7 Stairways and ramps. *Stairways* and *ramps* that are located below the lowest floor elevations specified in Section R322.3.2 shall comply with one or more of the following:

1. Be designed and constructed with open or partially open *risers* and *guards*.
2. *Stairways* and *ramps* not part of the required means of egress shall be designed and constructed to break away during design flood conditions without causing damage to the building or structure, including foundation.
3. Be retractable, or able to be raised to or above the lowest floor elevation, provided that the ability to be retracted or raised prior to the onset of flooding is not contrary to the means of egress requirements of the code.
4. Be designed and constructed to resist flood loads and minimize transfer of flood loads to the building or structure, including foundation.

Areas below *stairways* and *ramps* shall not be enclosed with walls below the elevation required in Section R322.3.2 unless such walls are constructed in accordance with Section R322.3.5.

R322.3.8 Decks and porches. Attached decks and porches shall meet the elevation requirements of Section R322.3.2 and shall either meet the foundation requirements of this section or shall be cantilevered from or knee braced to the building or structure. Self-supporting decks and porches that are below the elevation required in Section R322.3.2 shall not be enclosed by solid, rigid walls, including walls designed to break away. Self-supporting decks and porches shall be designed and constructed to remain in place during base flood conditions or shall be frangible and break away under base flood conditions.

R322.3.9 Construction documents. The *construction documents* shall include documentation that is prepared and sealed by a *registered design professional* that the design and methods of construction to be used meet the applicable criteria of this section.

R322.3.10 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.3.2. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of Section R322.3.

SECTION R323
STORM SHELTERS

R323.1 General. This section applies to *storm shelters* where constructed as separate detached buildings or where constructed as safe rooms within buildings for the purpose of providing refuge from storms that produce high winds, such as tornados and hurricanes. In addition to other applicable requirements in this code, storm shelters shall be constructed in accordance with ICC 500.

R323.1.1 Sealed documentation. The *construction documents* for all structural components and *impact protective systems* of the *storm shelter* shall be prepared and sealed by a *registered design professional* indicating that the design meets the criteria of ICC 500.

Exception: *Storm shelters*, structural components and impact-protective systems that are *listed* and *labeled* to indicate compliance with ICC 500.

SECTION R324
SOLAR ENERGY SYSTEMS

R324.1 General. Solar energy systems shall comply with the provisions of this section.

R324.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with Chapter 23.

[W][S] R324.3 Photovoltaic systems. Installation, modification, or *alteration* of solar photovoltaic power systems shall comply with this section and the *International Fire Code*. Section R104.6, alternate materials and methods, of this code shall be considered when approving the installation of solar photovoltaic power systems. Photovoltaic (PV) systems shall be designed and installed in accordance with Sections R324.3.1 through R324.7.1, the *Seattle Electrical Code* and the manufacturer's installation instructions. ((~~The electrical portion of solar PV systems shall be designed and installed in accordance with NFPA 70.~~)) Inverters shall be *listed* and *labeled* in accordance with UL 1741. Systems connected to the utility grid shall use inverters *listed* for utility interaction.

Exception: Detached, nonhabitable Group U structures shall not be subject to the requirements of this section for structural and life safety.

R324.3.1 Equipment listings. *Photovoltaic panels* and modules shall be *listed* and *labeled* in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Inverters shall be *listed* and *labeled* in accordance with UL 1741. Systems

connected to the utility grid shall use inverters *listed* for utility interaction. Mounting systems *listed* and *labeled* in accordance with UL 2703 shall be installed in accordance with the manufacturer's installation instructions and their listings.

[W] R324.4 Rooftop-mounted photovoltaic systems. Rooftop-mounted *photovoltaic panel systems* installed on or above the roof covering shall be designed and installed in accordance with ((~~this section~~)) Section R907.

Exceptions: The roof structure shall be deemed adequate to support the load of the rooftop solar photovoltaic system if all of the following requirements are met:

1. The solar photovoltaic panel system shall be designed for the wind speed of the local area, and shall be installed per the manufacturer's specifications.
2. The ground snow load does not exceed 70 pounds per square foot.
3. The total dead load of modules, supports, mountings, raceways, and all other appurtenances weigh no more than 4 pounds per square foot.
4. Photovoltaic modules are not mounted higher than 18 inches above the surface of the roofing to which they are affixed.
5. Supports for solar modules are to be installed to spread the dead load across as many roof-framing members as needed, so that no point load exceeds 50 pounds.

R324.4.1 Structural requirements. Rooftop-mounted *photovoltaic panel systems* shall be designed to structurally support the system and withstand applicable gravity loads in accordance with Chapter 3. The roof on which these systems are installed shall be designed and constructed to support the loads imposed by such systems in accordance with Chapter 8.

R324.4.1.1 Roof load. Portions of roof structures not covered with *photovoltaic panel systems* shall be designed for dead loads and roof loads in accordance with Sections R301.4 and R301.6. Portions of roof structures covered with *photovoltaic panel systems* shall be designed for the following load cases:

1. Dead load (including *photovoltaic panel* weight) plus snow load in accordance with Table R301.2.
2. Dead load (excluding *photovoltaic panel* weight) plus roof *live load* or snow load, whichever is greater, in accordance with Section R301.6.

R324.4.1.2 Wind load. Rooftop-mounted *photo-voltaic panel* or *module* systems and their supports shall be designed and installed to resist the component and cladding loads specified in Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

R324.4.2 Fire classification. Rooftop-mounted *photovoltaic panel systems* shall have the same fire classification as the *roof assembly* required in Section R902.

R324.4.3 Roof penetrations. Roof penetrations shall be flashed and sealed in accordance with Chapter 9.

R324.5 Building-integrated photovoltaic systems. Building-integrated photovoltaic (BIPV) systems that serve as roof coverings shall be designed and installed in accordance with Section R905.

R324.5.1 Photovoltaic shingles. Photovoltaic shingles shall comply with Section R905.16.

R324.5.2 Fire classification. *Building-integrated photovoltaic systems* shall have a fire classification in accordance with Section R902.3.

R324.5.3 BIPV roof panels. BIPV roof panels shall comply with Section R905.17.

R324.6 Roof access and pathways. Roof access, pathways and setback requirements shall be provided in accordance with Sections R324.6.1 through R324.6.2.1. Access and minimum spacing shall be required to provide emergency access to the roof, to provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.

Exceptions:

1. Detached, nonhabitable structures, including but not limited to detached garages, parking shade structures, carports, solar trellises and similar structures, shall not be required to provide roof access.
2. Roof access, pathways and setbacks need not be provided where the code official has determined that rooftop operations will not be employed.
3. These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (17-percent slope) or less.
4. BIPV systems *listed* in accordance with Section 690.12(B)(2) of NFPA 70, where the removal or cutting away of portions of the BIPV system during fire-fighting operations has been determined to not expose a fire fighter to electrical shock hazards.

R324.6.1 Pathways. Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36 inches (914 mm) wide, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or

driveway side of the roof. For each roof plane with a photovoltaic array, a pathway not less than 36 inches wide (914 mm) shall be provided from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling the same and adjacent roof planes. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment.

R324.6.2 Setback at ridge. For photovoltaic arrays occupying not more than 33 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

R324.6.2.1 Alternative setback at ridge. Where an automatic sprinkler system is installed within the dwelling in accordance with NFPA 13D or Section P2904, setbacks at ridges shall comply with one of the following:

1. For photovoltaic arrays occupying not more than 66 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge.
2. For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

R324.6.3 Emergency escape and rescue openings. Panels and modules installed on dwellings shall not be placed on the portion of a roof that is below an *emergency escape and rescue opening*. A pathway not less than 36 inches (914 mm) wide shall be provided to the emergency escape and rescue opening.

Exception: BIPV systems *listed* in accordance with Section 690.12(B)(2) of NFPA 70, where the removal or cutting away of portions of the BIPV system during fire-fighting operations has been determined to not expose a fire fighter to electrical shock hazards.

R324.7 Ground-mounted photovoltaic systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with Section R301.

R324.7.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the *fire separation distance* requirements determined by the local *jurisdiction*.

SECTION R325
MEZZANINES

[W] R325.1 General. *Mezzanines* shall comply with Sections R325 through ((~~R325.5~~)) R326. *Habitable attics* shall comply with Section 326.

R325.2 Mezzanines. The clear height above and below *mezzanine* floor construction shall be not less than 7 feet (2134 mm).

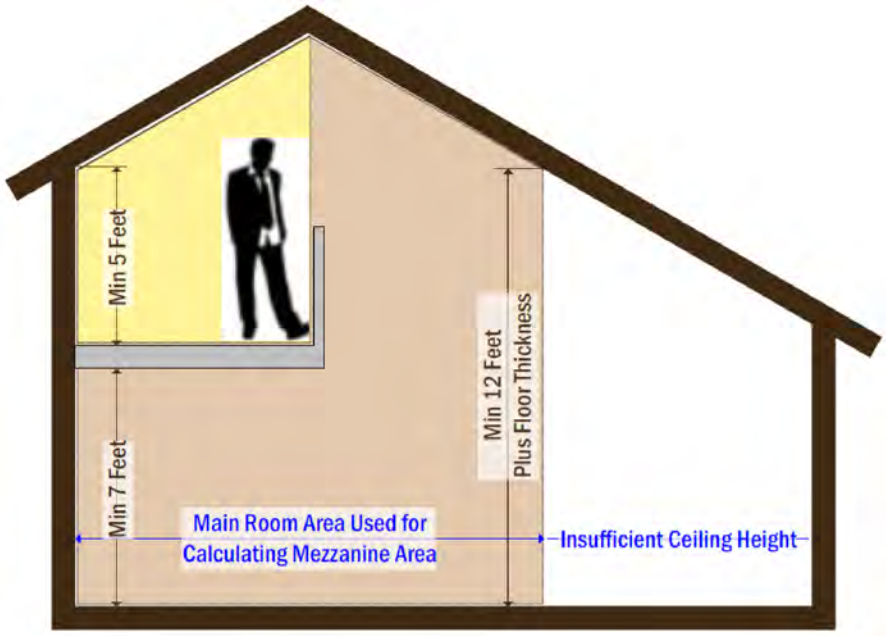
R325.3 Area limitation. The aggregate area of a *mezzanine* or *mezzanines* shall be not greater than one-third of the floor area of the room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the *mezzanine* is located.

Exception: The aggregate area of a *mezzanine* located within a *dwelling unit* equipped with an automatic sprinkler system in accordance with Section P2904 shall not be greater than one-half of the floor area of the room, provided that the *mezzanine* meets all of the following requirements:

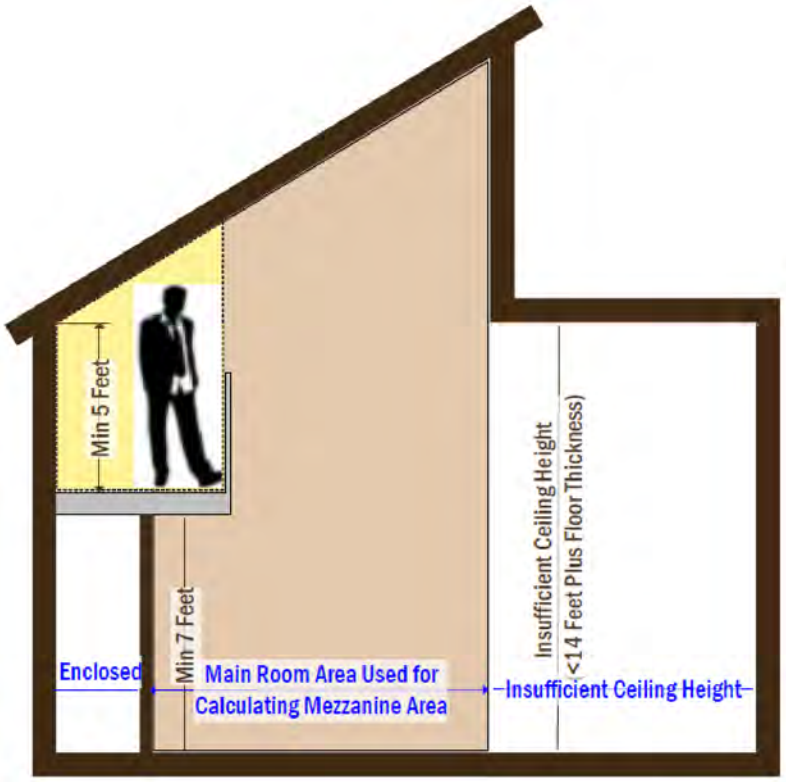
1. Except for enclosed closets and bathrooms, the *mezzanine* is open to the room in which such *mezzanine* is located.
2. The opening to the room is unobstructed except for walls not more than 42 inches (1067 mm) in height, columns and posts.
3. The exceptions to Section R325.5 are not applied.

Interpretation R325.3: Only the following unenclosed areas of the room or space containing the *mezzanine* shall be used for purposes of calculating the allowable *mezzanine* floor area:

1. Areas with a ceiling height of at least 7 feet located directly below the *mezzanine*, except that no additional area benefit shall be gained for stacked *mezzanines*; and
2. Areas where the ceiling has a slope of less than 2:12 and with a ceiling height of at least 14 feet plus the thickness of the *mezzanine* floor construction; and
3. Areas where the ceiling has a slope of 2:12 or more and has a ceiling height of at least 12 feet plus the thickness of the *mezzanine* floor construction, provided that the *mezzanine* complies with Section 1208.2, exception 2.



BASIS FOR CALCULATING ALLOWABLE MEZZANINE AREA WHEN USING SLOPED CEILING PROVISIONS



BASIS FOR CALCULATING ALLOWABLE MEZZANINE AREA WITH OTHER CONDITIONS

R325.4 Means of egress. The means of egress for *mezzanines* shall comply with the applicable provisions of Section R311.

[W] R325.5 Openness. *Mezzanines* shall be open and unobstructed to the room in which they are located except for walls not more than 36 inches (914 mm) in height, columns and posts.

Exceptions:

1. *Mezzanines* or portions thereof are not required to be open to the room in which they are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the *mezzanine* area.
2. ((~~In buildings~~)) Mezzanines that are not more than two stories above *grade plane* and equipped throughout with an automatic sprinkler system in accordance with Section R313, a *mezzanine* shall not be required to be open to the room in which the *mezzanine* is located.

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SECTION R326
HABITABLE ATTICS

[W] R326.1 General. Habitable attics shall comply with Sections ((~~R326.2 and R326.3~~)) R326 through R326.4.

Exception: Lofts in dwelling units and sleeping units shall be permitted to comply with Section R333, subject to the limitations in Section R333.1.

R326.2 Minimum dimensions. A habitable attic shall have a floor area in accordance with Section R304 and a ceiling height in accordance with Section R305.

R326.3 Story above grade plane. A habitable attic shall be considered a story above *grade plane*.

Exceptions: A habitable attic shall not be considered to be a story above *grade plane* provided that the habitable attic meets all the following:

1. The aggregate area of the habitable attic is either of the following:
   1.1. Not greater than one-third of the floor area of the story below.
   1.2. Not greater than one-half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.
2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
3. The floor of the habitable attic does not extend beyond the exterior walls of the story below.
4. Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section P2904.

[W] R326.4 Means of egress. The means of egress for habitable attics shall comply with the applicable provisions of Section R311.

Exception: Lofts in dwelling units and sleeping units shall be permitted to comply with Section R333, subject to the limitations in Section R333.1.

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SECTION R327
SWIMMING POOLS, SPAS AND HOT TUBS

[W] R327.1 General. The design and construction of swimming pools, ((~~and~~)) spas, and other aquatic recreation facilities, shall comply with the 2021 *International Swimming Pool and Spa Code* ((~~,~~)) if the facility is one of the following:

1. For the sole use of residents and invited guests at a single-family dwelling;
2. For the sole use of residents and invited guests of a duplex owned by the residents; or
3. Operated exclusively for physical therapy or rehabilitation and under the supervision of a licensed medical practitioner.

[W] SECTION R328
ENERGY STORAGE SYSTEMS

R328.1 General. *Energy storage systems (ESS)* shall comply with the provisions of this section.

Exceptions:

1. *ESS listed* and *labeled* in accordance with UL 9540 and marked "For use in residential dwelling units" where installed in accordance with the manufacturer's instructions and NFPA 70.
2. ESS less than 1 kWh (3.6 megajoules).

R328.2 Equipment listings. ((~~*Energy storage systems (ESS)*~~)) *ESS* shall be *listed* and *labeled* for residential use in accordance with UL 9540.

Exception:

1. Where *approved*, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.
2. Battery systems that are an integral part of an electric vehicle are allowed provided that the installation complies with Section 625.48 of NFPA 70.
3. Battery systems less than 1 kWh (3.6 megajoules).

R328.3 Installation. *ESS* shall be installed in accordance with the manufacturer's instructions and their *listing*.

R328.3.1 Spacing. Individual units shall be separated from each other by not less than 3 feet (914 mm) except where smaller separation distances are documented to be adequate based on large-scale fire testing complying with Section 1207.1.5 of the *International Fire Code*.

R328.4 Locations. *ESS* shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the *dwelling unit* living space in accordance with Section R302.6.
3. Outdoors or on the exterior side of exterior walls located not less than 3 feet (914 mm) from doors and windows directly entering the *dwelling unit*.
4. Enclosed utility closets, basements, storage or utility spaces within *dwelling units* with finished or noncombustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than 5/8-inch (15.9 mm) Type X gypsum wallboard.

ESS shall not be installed in sleeping rooms, or closets or spaces opening directly into sleeping rooms.

R328.5 Energy ratings. Individual *ESS* units shall have a maximum rating of 20 kWh. The aggregate rating of the *ESS* shall not exceed:

1. 40 kWh within utility closets, basements and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1207 of the *International Fire Code*.

R328.6 Electrical installation. *ESS* shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters *listed* for utility interaction.

R328.7 Fire detection. Rooms and areas within *dwelling units*, basements and attached garages in which *ESS* are installed shall be protected by smoke alarms in accordance with Section R314. A heat detector, *listed* and interconnected to the smoke alarms, shall be installed in locations within *dwelling units* and attached garages where smoke alarms cannot be installed based on their listing.

R328.8 Protection from impact. *ESS* installed in a location subject to vehicle damage shall be protected by *approved* barriers.

R328.9 Ventilation. Indoor installations of *ESS* that produce hydrogen or other flammable gases during charging shall be provided with mechanical *ventilation* in accordance with Section M1307.4.

R328.10 Electric vehicle use. The temporary use of an *owner* or occupant's electric-powered vehicle to power a *dwelling unit* while parked in an attached or detached garage or outdoors shall comply with the vehicle manufacturer's instructions and NFPA 70.

R328.11 Documentation and labeling. The following information shall be provided:

1. A copy of the manufacturer's installation, operation, maintenance and decommissioning instructions shall be provided to the owner or placed in a conspicuous location near the *ESS* equipment.
2. A label on the installed system containing the contact information for the qualified maintenance and service providers.

R328.12 Commissioning. ESS shall be commissioned as follows:

1. Verify that the system is installed in accordance with the approved plans and manufacturer's instructions and is operating properly.
2. Provide a copy of the manufacturer's installation, operation, maintenance, and decommissioning instructions provided with the listed system.

3. Provide a label on the installed system containing the contact information for the qualified maintenance and service providers.

R328.12.1 Installation prior to closing. Where the system is installed in a one- or two-family dwelling or townhouse that is owned by the builder and has yet to be sold, commissioning shall be conducted as outlined in Section R328.12, and the builder shall then transfer the required information in Section R328.12 to the homeowner when the property is transferred to the owner at the closing.

SECTION R329
STATIONARY ENGINE GENERATORS

R329.1 General. Stationary engine generators shall be *listed* and *labeled* in accordance with UL 2200 and shall comply with this section. The connection of stationary engine generators to the premise wiring system shall be by means of a *listed* transfer switch.

R329.2 Installation. The installation of stationary engine generators shall be in an *approved* location and in accordance with the listing, the manufacturer's installation instructions and Chapters 34 through 43.

[W] SECTION R330
ADULT FAMILY HOMES

R330.1 General. This section shall apply to all newly constructed *adult family homes* and all existing single family homes being converted to *adult family homes*. This section shall not apply to those *adult family homes* licensed by the state of Washington Department of Social and Health Services prior to July 1, 2001.

R330.2 Sleeping room classification. Each sleeping room in an *adult family home* shall be classified as:

1. Type S - Where the means of egress contains stairs, elevators or platform lifts.
2. Type NS1 - Where one means of egress is at grade level or a ramp constructed in accordance with Section R330.8 is provided.
3. Type NS2 - Where two means of egress are at grade level or ramps constructed in accordance with Section R330.8 are provided.

R330.3 Types of locking devices and door activation. All bedroom and bathroom doors shall be openable from the outside when locked.

Every closet shall be readily openable from the inside.

Operable parts of door handles, pulls, latches, locks and other devices installed in *adult family homes* shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

Pocket doors shall have graspable hardware available when in the closed or open position.

The force required to activate operable parts shall be 5.0 pounds (22.2 N) maximum. Required exit doors shall have no additional locking devices.

Required exit door hardware shall unlock inside and outside mechanisms when exiting the building allowing reentry into the *adult family home* without the use of a key, tool or special knowledge.

R330.4 Smoke and carbon monoxide alarm requirements. All *adult family homes* shall be equipped with smoke and carbon monoxide alarms installed as required in Sections R314 and R315. Alarms shall be installed in such a manner so that the detection device warning is audible from all areas of the *dwelling* upon activation of a single alarm.

R330.5 Escape windows and doors. Every sleeping room shall be provided with emergency escape and rescue windows as required by Section R310. No alternatives to the sill height such as steps, raised platforms or other devices placed by the openings will be *approved* as meeting this requirement.

R330.6 Fire apparatus access roads and water supply for fire protection. *Adult family homes* shall be served by fire apparatus access roads and water supplies meeting the requirements of the local jurisdiction.

R330.7 Grab bar general requirements. Where facilities are designated for use by *adult family home* clients, grab bars for water closets, bathtubs and shower stalls shall be installed according to this section.

R330.7.1 Grab bar cross section. Grab bars with a circular cross section shall have an outside diameter of 1-1/4 inches minimum and 2 inches maximum. Grab bars with noncircular cross section shall have a cross section dimension of 2 inches maximum and a perimeter dimension of 4 inches minimum and 4-5/8 inches maximum.

R330.7.2 Grab bar installation. Grab bars shall have a spacing of 1-1/2 inches between the wall and the bar. Projecting objects, control valves and bathtub or shower stall enclosure features above, below and at the ends of the grab bar shall have a clear space of 1-1/2 inches to the grab bar.

Exception: Swing-up grab bars shall not be required to meet the 1-1/2 inch spacing requirement. Grab bars shall have a structural strength of 250 pounds applied at any point on the grab bar, fastener, mounting device or supporting structural member. Grab bars shall not be supported directly by any residential grade fiberglass bathing or showering unit. Acrylic bars found in bathing units shall be removed. Fixed position grab bars, when mounted, shall not rotate, spin or move, and shall have a graspable surface finish.

R330.7.3 Grab bars at water closets. Water closets shall have grab bars mounted on both sides. Grab bars can be a combination of fixed position and swing-up bars. Grab bars shall meet the requirements of Section R330.7. Grab bars shall mount between 33 inches and 36 inches above floor grade. Centerline distance between grab bars, regardless of type used, shall be between 25 inches minimum and 30 inches maximum.

R330.7.3.1 Fixed position grab bars. Fixed position grab bars shall be at least 36 inches in length and start 12 inches from the rear wall.

R330.7.3.2 Swing-up grab bars. Swing-up grab bars shall be a minimum of 28 inches in length from the rear wall.

R330.7.4 Grab bars at bathtubs. Horizontal and vertical grab bars shall meet the requirements of Section R330.8.

R330.7.4.1 Vertical grab bars. Vertical grab bars shall be a minimum of 18 inches long and installed at the control end wall and head end wall. Grab bars shall be mounted within 4 inches of the exterior of the bathtub edge or within 4 inches within the bathtub. The bottom end of the bar shall start between 36 inches and 42 inches above floor grade.

Exception: The required vertical grab bar can be substituted with a floor to ceiling grab bar meeting the requirements of Section R330.7 at the control end and head end entry points.

R330.7.4.2 Horizontal grab bars. Horizontal grab bars shall be provided at the control end, head end, and the back wall within the bathtub area. Grab bars shall be mounted between 33 inches and 36 inches above floor grade. Control end and head end grab bars shall be at least 24 inches in length. Back wall grab bars shall be at least 36 inches in length.

R330.7.5 Grab bars at shower stalls. Where shower stalls are provided to meet the requirements for bathing facilities, grab bars shall meet the requirements of Section R330.7.

Exception: Shower stalls with permanent built-in seats are not required to have vertical or horizontal grab bars at the seat end wall. A vertical floor to ceiling grab bar shall be installed within 4 inches of the exterior of the shower aligned with the nose of the built-in seat.

R330.7.5.1 Vertical grab bars. Vertical grab bars shall be at least 18 inches minimum in length and installed at the control end wall and head end wall. Vertical bars shall mount within 4 inches of the exterior of the shower stall or within 4 inches inside the shower stall. The bottom end of vertical bars shall be mounted between 36 inches and 42 inches above floor grade.

R330.7.5.2 Horizontal grab bars. Horizontal grab bars shall be installed on all sides of the shower stall mounted between 33 inches and 36 inches above the floor grade. Horizontal grab bars shall be a maximum of 6 inches from adjacent walls. Horizontal grab bars shall not interfere with shower control valves.

R330.8 Ramps. All interior and exterior *ramps*, when provided, shall be constructed in accordance with Section R311.8 with a maximum slope of 1 vertical to 12 horizontal. The exception to Section R311.8.1 is not allowed for *adult family homes*. Handrails shall be installed in accordance with Section R330.8.1.

R330.8.1 Handrails for ramps. Handrails shall be installed on both sides of ramps between the slope of 1 vertical to 12 horizontal and 1 vertical and 20 horizontal in accordance with Sections R311.8.1 through R311.8.3.3.

R330.9 Stair treads and risers. Stair treads and risers shall be constructed in accordance with Section R311.7.5. Handrails shall be installed in accordance with Section R330.9.1.

R330.9.1 Handrails for treads and risers. Handrails shall be installed on both sides of treads and risers numbering from one riser to multiple risers. Handrails shall be installed in accordance with Sections R311.7.8 through R311.7.8.4.

R330.10 Shower stalls. Where provided to meet the requirements for bathing facilities, the minimum size of shower stalls for *adult family homes* shall be 30 inches deep by 48 inches long.

[W] SECTION R331
FAMILY HOME CHILD CARE

R331.1 Family home child care. For *family home child care* with more than six children, each floor level used for family child care purposes shall be served by two remote means of egress. Exterior exit doors shall be operable from the inside without the use of keys or any special knowledge or effort.

Basements located more than 4 feet (1219 mm) below grade level shall not be used for *family home child care* unless one of the following conditions exist:

1. Stairways from the *basement* open directly to the exterior of the building without entering the first floor; or

2. One of the two required means of egress discharges directly to the exterior from the *basement* level, and a self-closing door is installed at the top or bottom of the interior stair leading to the floor above; or
3. One of the two required means of egress is an operable window or door, *approved* for emergency escape or rescue, that opens directly to a public street, public alley, *yard* or exit court; or
4. An automatic residential sprinkler system shall be designed and installed in accordance with Section P2904 or NFPA 13D.

Floors located more than 4 feet above grade level shall not be occupied by children in *family home child care*.

Exceptions:

1. Use of toilet facilities while under supervision of an adult staff person.
2. *Family home child care* may be allowed on the second story if one of the following conditions exists:
   2.1. Stairways from the second story open directly to the exterior of the building without entering the first floor; or
   2.2. One of the two required means of egress discharges directly to the exterior from the second story level, and a self-closing door is installed at the top or bottom of the interior stair leading to the floor below; or
   2.3. An automatic residential sprinkler system shall be designed and installed in accordance with Section P2904 or NFPA 13D.

Every sleeping or napping room in a *family home child care* shall have at least one operable window for emergency rescue.

Exception: Sleeping or napping rooms having doors leading to two separate means of egress, or a door leading directly to the exterior of the building.

Rooms or spaces containing a commercial-type cooking kitchen, boiler, maintenance shop, janitor closet, laundry, wood-working shop, flammable or combustible storage, or painting operation shall be separated from the *family home child care* area by at least one-hour fire-resistant construction.

Exception: A fire-resistant separation shall not be required where the food preparation kitchen contains only a domestic cooking range, and the preparation of food does not result in the production of smoke or grease-laden vapors.

Smoke alarms shall be installed in accordance with the requirements of new construction per Section R314. In addition to the required smoke alarms, a heat alarm shall be provided in each kitchen.

R331.2 Additional requirements for family home child care with 13 to 16 children. In addition to the requirements of Section 331.1 the provisions of this section shall apply to *family home child care* with 13 to 16 children.

R331.2.1 Illumination in the event of power failure. In addition to illumination requirements of Section R311.7.9, an artificial light source that activates upon termination of building power supply shall be installed at all interior stairs serving child care areas.

R331.2.2 Exterior exit doors serving child care areas. Exterior exit doors serving child care areas shall comply with the requirements of Sections R311.2 and R311.3.

R331.3 Sprinklers. An automatic residential sprinkler system shall be designed and installed in accordance with Section P2904 or NFPA 13D.

EXCEPTION: Subject to approval of the code official, a sprinkler system is not required where all of the following conditions are met:

1. Child care areas are located on a floor within 4 feet of grade level;
2. Each room used for child care shall have a door compliant with Section R311.2 and R311.3, leading directly to the exterior of the building. The exterior landing at the door shall comply with Section R311.3 but need not comply with Section R311.3.1.

SECTION R332
FLOATING HOMES

R332.1 Moorage location. Every *floating home moorage* shall be located on privately owned or privately controlled premises in accordance with the Land Use Code, Title 23 of the *Seattle Municipal Code*.

R332.2 Land access. Every *floating home moorage* shall have not less than 20 feet (6096 mm) of land frontage abutting a public street sufficiently improved for automobile travel.

R332.3 Moorage walkways. Every *floating home moorage* shall have firm and substantial walkways with a net width of not less than 4 feet (1219 mm) and extending from land to every *floating home site* in the moorage.

R332.4 Moorage lighting. Every *floating home moorage* and the walkways to every *floating home site* shall be illuminated to provide safe access. All luminaires shall be *listed* for the use.

R332.5 Fire protection. *Floating home moorages* shall be provided with fire extinguishing *equipment* as follows:

1. Portable fire-protection *equipment.* One fire extinguisher, 2A, 20-B:C rating minimum, shall be provided in each required hose station. The fire chief shall designate the type and number of all other fire *appliances* to be installed and maintained in each *floating home moorage*.
2. Standpipes. All portions of floats exceeding 250 feet (76 500 mm) in distance from fire apparatus access and marine service stations shall be provided with an *approved* Class I standpipe system installed according to International Building Code Section 905 and the *International Fire Code*.

R332.6 Water service connections. Every *floating home moorage* shall have a water service connection and shall provide water service *piping* securely fastened and stabilized above water from the water service connection to an outlet connection at each *floating home site* on a *floating home moorage*. The water *piping* in every *floating home* in a *floating home moorage* shall be connected to the water service outlet serving the *floating home* and the connection shall be securely fastened and stabilized above high water line. Water service connections and water service *piping* shall be constructed, installed and maintained in accordance with applicable standards established by or pursuant to ordinance.

R332.7 Public sewer connection. Every *floating home moorage* any part of which is within 300 feet (91 440 mm) of a public sewer and every *floating home moorage* on Shilshole Bay, Salmon Bay, Lake Washington Ship Canal, Lake Union, Portage Bay, Union Bay and that portion of Lake Washington lying within the city limits of Seattle shall have a lawfully installed connection to a public sewer.

R332.8 Local side sewer system. Every *floating home moorage* within the limits specified in Section R332.7 shall provide a local side sewer system for the collection of *sewage* from every *floating home* in the moorage. The local side sewer system shall be connected to the public sewer, shall have an inlet connection at each *floating home site* and shall be constructed, installed and maintained in accordance with this and all other applicable ordinances regulating the construction, *alteration*, repair and connection of side sewers.

R332.9 Connection to local side sewer system. Every *floating home* in a *floating home moorage* that is required under Section R332.7 to be connected to a public sewer shall be connected to the local side sewer system. Owners and operators of *floating home moorages* shall not permit any *floating home* to be moored at any moorage under their control unless the *floating home* is connected to the local side sewer system. It is a violation for any person to use, occupy or let any *floating home* for human habitation within the limits specified in Section R332.7 unless it is connected to the sewer system.

A reconnection permit is required for any *floating home* that is relocated from its original site of connection to a local side sewer system. Such reconnection is subject to the approval of the Director of Seattle Public Utilities.

R332.10 Sewer installation fees. The fee for the installation of any side sewer serving a *floating home moorage* is the fee provided by law for the connection to the public sewer of side sewers serving mobile home parks.

R332.11 Plumbing systems. All plumbing and plumbing systems in every *floating home* shall meet the requirements of the *Uniform Plumbing Code* except as otherwise *approved* by the Director of Public Health.

R332.12 Garbage disposal. Every *floating home moorage* shall be provided with adequate *garbage* storage and collection facilities, which shall be located in an accessible place on the moorage site. No garbage or refuse shall be thrown or dumped into the waters.

R332.13 Electrical service and wiring. Electrical service *approved* by City Light shall be provided to *floating homes* and *floating home moorages*. Electrical wiring and *equipment* in every *floating home* shall conform to requirements of the *Seattle Electrical Code*. No *floating home* shall be permitted to connect or reconnect to the electric utility's distribution system unless *approved* for such connection by the *building official* in accordance with the *Seattle Electrical Code*.

R332.14 Housing standards for existing floating homes. Every *floating home* shall comply with the minimum housing standards of the *Seattle Housing and Building Maintenance Code* except as otherwise *approved* by the *building official* in accordance with the *Housing and Building Maintenance Code*.

R332.15 Property lines. The boundaries of *floating home moorage* sites shall be considered the *lot line* for determining compliance with Section R302.

Interpretation R332.15: For the purposes of determining the required wall and opening protection and roof-covering requirements, distance shall be measured to the *exterior wall* of the home, and not to the float.

R332.16 Approval of moorage site plan required. Every *floating home moorage* shall continuously conform to a moorage site plan that has been *approved* by the *building official*. Such approval shall be obtained as follows: Three copies of the site plan, drawn to scale and completely dimensioned, and setting forth the address and legal description of the property on which

the moorage is located and the name and address of the owner or operator of the moorage, shall be filed with the *building official*.

The moorage site plan shall show:

1. The dimensions of the *floating home moorage* site;
2. The location of abutting public waterways;
3. The location and dimensions of private waterways and land access to the moorage;
4. The location and identification of individual *floating home sites*;
5. The location and dimensions of off-street parking spaces;
6. The location and dimensions of walkways and any *accessory structures* or facilities;
7. The water service system;
8. The local side sewer system; and
9. The electrical service and lighting system.

The site plan shall be reviewed by the code official, the Fire Chief, the Director of Public Health, the Director of Seattle Public Utilities and the Director of Transportation for conformance with the requirements of this code and other applicable ordinances. Upon approval by the *building official*, one copy of the *approved* site plan shall be retained in the office of the *building official*, one copy in the office of the Director of Public Health and one copy, which shall be maintained on the premises of the *floating home moorage*, shall be returned to the owner or operator.

R332.17 Moorage register of ownership. Every owner or operator of a *floating home moorage* shall maintain a current register of every *floating home* moored on the premises, such register to record the name and address of the legal owner of each *floating home* and the registration number assigned to it by the King County Assessor. A copy of the register shall be made available upon request to any City department referred to in this chapter.

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[W] SECTION R333
LOFTS

R333.1 General. Where provided in dwelling units or sleeping units, *lofts* shall comply with Sections R333.1 through R333.5. Lofts constructed in compliance with this section shall be considered a portion of the story below. Such lofts shall not contribute to the number of stories as regulated by this code.

Exception: Lofts need not comply with Section R333 where they meet any of the following conditions:

1. The loft has maximum depth of less than 3 feet (914 mm).
2. The loft has a floor area of less than 35 square feet (3.3 m^2).
3. The loft is not provided with a permanent means of egress.

R333.2 Loft limitations. Lofts shall comply with the following conditions:

1. The loft floor area shall be less than 70 square feet (6.5 m^2).
2. The loft ceiling height shall not exceed 7 feet (2134 mm) for more than one-half of the loft floor area. The provisions of Sections R333.3 through R333.5 shall not apply to lofts that do not comply with Items 1 and 2 of this section.

R333.3 Loft ceiling height. The ceiling height below a loft shall not be less than 7 feet (2134 mm). The ceiling height above the finished floor of the loft shall not be less than 3 feet (914 mm). Portions of the loft with a sloped ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not contribute to the loft floor area.

R333.4 Loft area. The aggregate area of all lofts and mezzanines within a room shall comply with Section R325.3.

Exception: The area of a single loft located within a dwelling unit or sleeping unit equipped with an automatic sprinkler system in accordance with Section P2904 shall not be greater than two-thirds of the area of the room in which it is located, provided that no other lofts or mezzanines are open to the room in which the loft is located.

R333.5 Permanent egress for lofts. Where a permanent means of egress is provided for lofts, the means of egress shall comply with Section R311 as modified by Section R333.5.1.

R333.5.1 Ceiling height at loft means of egress. A minimum ceiling height of 3 feet shall be provided for the entire width of the means of egress from the loft.

SECTION ((~~R330~~)) R334
STATIONARY FUEL CELL POWER SYSTEMS

((~~R330.1~~)) R334.1 General. *Stationary fuel cell power systems* in new and existing buildings and structures shall comply with Section 1206 of the *International Fire Code*.

[S] SECTION R335
SECURITY FROM CRIMINAL ACTIVITY

R335.1 Building entrance locks. Building entrance doors, including garage doors, shall be capable of locking. They shall be equipped with a dead-locking latch bolt with at least a 1/2-inch throw that penetrates the striker not less than 1/4 inch. Building entrance doors shall be openable from the inside without use of a key or special knowledge or effort.

Exception: Garage-to-exterior doors are permitted to be equipped with an electronically operated remote control device for opening and closing in lieu of a dead-locking latch bolt. When garage-to-exterior doors are equipped with remote control devices, garage-to-building doors need not be capable of locking.

R335.2 Observation ports. Every building entrance door, other than garage doors, shall have a visitor observation port or glass side light. Observation ports shall be installed at a height of not less than 54 inches (1372 mm) and not more than 66 inches (1676 mm) from the floor.

R335.3 Windows and sliding doors. Dead bolts or other *approved* locking devices shall be provided on all sliding doors and openable windows. The lock shall be installed so that the mounting screws for the lock case are inaccessible from the outside.

Exception: Windows with sills located 10 feet (3048 mm) or more above grade, or 10 feet or more above a deck, balcony or porch that is not *readily accessible* from grade except through a housing unit need not have operable inside latching devices.

R335.4 Alternate security devices. Subject to the approval of the *building official*, alternate security devices are permitted to be substituted for those required by this section. Alternate devices must have equal capability to resist illegal entry. The installation of the device shall not conflict with other requirements of this code and other ordinances regulating the safety of exiting.

[S] SECTION R336
SOUND TRANSMISSION CONTROL

R336.1 General. Wall and floor-ceiling assemblies separating *dwelling units* shall provide sound insulation in accordance with this Section R336.

R336.1.1 Perimeter joints. Joints in the perimeter of such separating wall or floor-ceiling assembly shall be acoustically sealed with a permanent resilient material *approved* for the purpose. The separating wall or floor-ceiling assembly shall extend completely to and be sealed to another separating assembly or an *exterior wall*, roof or floor assembly.

R336.1.2 Penetrations. Conduits, ducts, pipes and vents within the wall or floor-ceiling assembly causing vibration shall be reasonably isolated from the building construction at points of support by means of resilient sleeves, mounts or underlayments. All other openings through which such conduits, ducts, pipes or vents pass shall have the excess opening fully sealed with insulative and permanently resilient materials *approved* for the purpose.

R336.1.3 Fire-resistance ratings. Design and materials for sound transmission control shall not impair the fire-resistance rating of separating walls or floor-ceiling assemblies required to be of fire-resistance-rated construction.

R336.2 Airborne sound. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a Sound Transmission Class (STC) rating of 45 when tested in accordance with ASTM E 90.

R336.2.1 Outlet boxes. Electrical outlet boxes shall not be placed back-to-back and shall be offset by not less than 12 inches (305 mm) from outlets in the opposite wall surface. The back and sides of boxes shall be sealed with 1/8-inch resilient sealant and backed by a minimum of 2-inch-thick mineral fiber insulation or *approved* equivalent.

R336.3 Structural-borne sound. Floor-ceiling assemblies between *dwelling units* or between a *dwelling unit* and a public or service area within a structure shall have an Impact Insulation Class (IIC) rating of not less than 50 when tested in accordance with ASTM E 492. Floor covering may be included in the assembly to obtain the required ratings.

Exception: Floor assemblies in bathrooms are not required to meet the IIC rating of 50 where structural concrete floor systems are used.

R336.4 Tested assemblies. Field- or laboratory-tested wall or floor-ceiling designs having an STC or IIC of 50 or more may be used without additional field testing when, in the opinion of the *building official*, the tested design has not been compromised by flanking paths. Tests may be required by the *building official* when evidence of compromised separations is noted. Wall or floor-ceiling designs field tested by ASTM E 336 having a minimum FSTC or FIIC rating of 45 may be used.

R336.5 Field testing and certification. Field testing, when permitted to determine airborne sound transmission or impact sound insulation class, shall be done in accordance with ASTM E 492 under the supervision of an acoustical professional who is experienced in the field of acoustical testing and engineering and who shall forward certified test results to the *building official* that minimum sound insulation requirements stated above have been met.

R336.6 Sound transmission control systems. Generic systems *listed* in GA 600 may be accepted where a laboratory test indicates that the requirements of Section R336 are met by the system.

R401.4.2 Compressible or shifting soil. Instead of a complete geotechnical evaluation, where top or subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to ensure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.

[S] R401.5 Protection of adjoining property. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. When the existing grade of a site is altered by filling, excavating, dredging or moving of earth materials, the owner shall protect all adjoining property during construction from encroachment or collapse by sloping the sides of the temporary grading at a slope that is safe and not more than one horizontal to one vertical. In addition, adjoining property shall be protected from encroachment or collapse by sloping the sides of the permanent grading at a slope not greater than two horizontal to one vertical. The *building official* is authorized to approve temporary or permanent slopes that are steeper based on a design by an experienced geotechnical engineer.

In areas of known unsuitable soils, the *building official* is authorized to require slopes that are less steep to assure protection of adjoining property.

SECTION R402
MATERIALS

R402.1 Wood foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of this code.

R402.1.1 Fasteners. Fasteners used below *grade* to attach plywood to the exterior side of exterior *basement* or crawl-space wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above *grade* to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled galvanized (zinc coated) steel nails. Electro-galvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

R402.1.2 Wood treatment. Lumber and plywood shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.2), and shall bear the *label* of an accredited agency. Where lumber or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain not less than 2-percent copper metal, by repeated brushing, dipping or soaking until the wood cannot absorb more preservative.

R402.2 Concrete. Concrete shall have a minimum specified compressive strength of f'_c, as shown in Table R402.2. Concrete subject to moderate or severe weathering as indicated in Table R301.2 shall be air entrained as specified in Table R402.2. The maximum weight of fly ash, other pozzolans, silica fume, slag or blended cements that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in Section 19.3.3.4 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapters 19 and 20 of ACI 318 or ACI 332.

Code Alternate R402.2: Five-sack 2000 psi (13 790 kPa) and 5-1/2-sack 2500 psi (17 237 kPa) concrete mixes in accordance with *International Building Code* Section 1904.2 are equivalent to 3000 psi (20 684 kPa) concrete for weathering potential. In addition, air-entrainment is not required to address weathering.

R402.2.1 Materials for concrete. Materials for concrete shall comply with the requirements of Section R608.5.1.

TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH[a] (f'_c)		
	Weathering Potential[b]		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500[c]
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500[c]
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000[d]	3,000[d]
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000[d, e, f]	3,500[d, e, f]

For SI: 1 pound per square inch = 6.895 kPa.

a. Strength at 28 days psi.

b. See Table R301.2 for weathering potential.

c. Concrete in these locations that is subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Note d.
d. Concrete shall be air-entrained. Total air content (percent by volume of concrete) shall be not less than 5 percent or more than 7 percent.
e. See Section R402.2 for maximum cementitious materials content.
f. For garage floors with a steel-troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.

R402.3 Precast concrete. *Precast concrete* foundations shall be designed in accordance with Section R404.5 and shall be installed in accordance with the provisions of this code and the manufacturer's instructions.

R402.3.1 Precast concrete foundation materials. Materials used to produce *precast concrete* foundations shall meet the following requirements:

1. All concrete used in the manufacture of *precast concrete* foundations shall have a minimum compressive strength of 5,000 psi (34 470 kPa) at 28 days. Concrete exposed to a freezing and thawing environment shall be air entrained with a minimum total air content of 5 percent.
2. Structural reinforcing steel shall meet the requirements of ASTM A615, A706M or A996M. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). Steel reinforcement for *precast concrete foundation walls* shall have a minimum concrete cover of 3/4 inch (19.1 mm).
3. Panel-to-panel connections shall be made with Grade II steel fasteners.
4. The use of nonstructural fibers shall conform to ASTM C1116.
5. Grout used for bedding precast foundations placed on concrete footings shall meet ASTM C1107.

R402.4 Masonry. Masonry systems shall be designed and installed in accordance with this chapter and shall have a minimum specified compressive strength of 1,500 psi (10.3 MPa).

SECTION R403
FOOTINGS

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems that shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill. Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

R403.1.1 Minimum size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3, as applicable, but not less than 12 inches (305 mm) in width and 6 inches (152 mm) in depth. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section ((~~R1001.2~~)) R1001. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3). Footings for precast foundations shall be in accordance with the details set forth in Section R403.4, Table R403.4, and Figures R403.4(1) and R403.4(2).

TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME	LOAD-BEARING VALUE OF SOIL (psf)					
		1,500	2,000	2,500	3,000	3,500	4,000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—plus basement	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6

Exceptions:

1. Protection of free-standing *accessory structures* with an area of 600 square feet (56 m^2) or less, of *light-frame construction*, with an eave height of 10 feet (3048 mm) or less shall not be required.
2. Protection of free-standing *accessory structures* with an area of 400 square feet (37 m^2) or less, of other than *light-frame construction*, with an eave height of 10 feet (3048 mm) or less shall not be required.

R403.1.5 Slope. The top surface of footings shall be level. The bottom surface of footings shall not have a slope exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed 1 unit vertical in 10 units horizontal (10-percent slope).

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum 1/2-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of *concrete masonry units*. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be permitted to be located while concrete is still plastic and before it has set. Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset *braced wall panels* shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent *braced wall panels* at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent *braced wall panels* at corners as shown in Item 9 of Table R602.3(1).

Interpretation I403.1.6: Anchor bolts for hold downs are not permitted to be wet set.

R403.1.6.1 Foundation anchorage in Seismic Design Categories C, D_0, D_1 and D_2. In addition to the requirements of Section R403.1.6, the following requirements shall apply to wood light-frame structures in *Seismic Design Categories* D_0, D_1 and D_2 and wood light-frame *townhouses* in Seismic Design Category C.

1. Plate washers conforming to Section R602.11.1 shall be provided for all anchor bolts over the full length of required *braced wall lines* except where *approved* anchor straps are used. Properly sized cut washers shall be permitted for anchor bolts in wall lines not containing *braced wall panels*.
2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located within 12 inches (305 mm) of the ends of each plate section where supported on a continuous foundation.
3. Interior bearing wall sole plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located within 12 inches (305 mm) of the ends of each plate section where supported on a continuous foundation.
4. The maximum anchor bolt spacing shall be 4 feet (1219 mm) for buildings over two *stories* in height.
5. Stepped cripple walls shall conform to Section R602.11.2.
6. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the *braced wall panel* shall be connected to the wood foundations in accordance with the *braced wall panel*-to-floor fastening requirements of Table R602.3(1).

R403.1.7 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in 3 units horizontal (33.3-percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4.

SECTION R408
UNDER-FLOOR SPACE

[W] R408.1 ((~~Moisture control~~)) Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a *basement*) shall ((~~comply with Section R408.2 or R408.3~~)) have ventilation openings through foundation walls or exterior walls. A ground cover of six mil (0.006 inch thick) black polyethylene or *approved* equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped six inches minimum at the joints and shall extend to the foundation wall.

Exception: The ground cover may be omitted in crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of two inches.

[W] R408.2 Openings for under-floor ventilation. ((~~Ventilation openings through foundation or exterior walls surrounding the under-floor space shall be provided in accordance with this section.~~)) The minimum net area of ventilation openings shall not be ((~~not~~)) less than 1 square foot (0.0929 m^2) for each ((~~150~~)) 300 square feet (((~~14~~)) 28 m^2) of under-floor area. ((~~One ventilation opening shall be within 3 feet (915 mm) of each external corner of the under-floor space.~~)) Required openings shall be evenly placed to provide cross ventilation of the space except one side of the building shall be permitted to have no ventilation openings. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed 1/4 inch (6.4 mm), and operational louvers are permitted:

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grill or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being 1/8 inch (3.2 mm). ((~~thick.~~))

((~~Exceptions~~)) Exception: ((~~1.~~)) The total area of ventilation openings shall be permitted to be reduced to 1/1,500 of the under-floor area where the ground surface is covered with an *approved* Class I vapor retarder material and the required openings are placed to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited. If the installed ventilation is less than 1/300, or if operable louvers are installed, a radon vent shall be installed to originate from a point between the ground cover and soil. The radon vent shall be installed in accordance with the requirements of Appendix F (Radon) of this code.

((~~2. Where the ground surface is covered with an *approved* Class 1 vapor retarder material, ventilation openings are not required to be within 3 feet (915 mm) of each external corner of the under-floor space provided that the openings are placed to provide cross ventilation of the space.~~))

[W] R408.3 Unvented crawl space. ((~~For unvented~~)) Ventilation openings in under-floor spaces ((~~, the following items shall be provided~~)) specified in Section R408.2 shall not be required where:

1. Exposed earth ((~~shall be~~)) is covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall ((~~or insulation~~)) and a radon system shall be installed that meets the requirements of Appendix F.

((~~2. One of the following shall be provided for the under-floor space:~~

~~2.1. Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of *crawl space* floor area, including an air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.~~

~~2.2. *Conditioned air* supply sized to deliver at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of under-floor area, including a return air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.~~

~~2.3. Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.~~

~~2.4. Dehumidification sized in accordance with manufacturer's specifications.~~))

2. Continuously operated mechanical exhaust ventilation is provided at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of crawlspace floor area. Exhaust ventilation shall terminate to the exterior.

   Exception: *Plenums* in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.

R408.4 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be not smaller than 18 inches by 24 inches (457 mm by 610 mm). Openings through a perimeter wall shall be not less than 16 inches by 24 inches (407 mm by 610 mm). Where any portion of the through-wall access is below *grade*, an areaway not less than 16 inches by 24

inches (407 mm by 610 mm) shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See Section M1305.1.3 for access requirements where mechanical *equipment* is located under floors.

R408.5 Removal of debris. The under-floor *grade* shall be cleaned of all vegetation and organic material. Wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. Construction materials shall be removed before a building is occupied or used for any purpose.

R408.6 Finished grade. The finished *grade* of under-floor surface shall be permitted to be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the *grade* in the under-floor space shall be as high as the outside finished *grade*, unless an *approved* drainage system is provided.

R408.7 Flood resistance. For buildings located in flood hazard areas as established in Table R301.2:

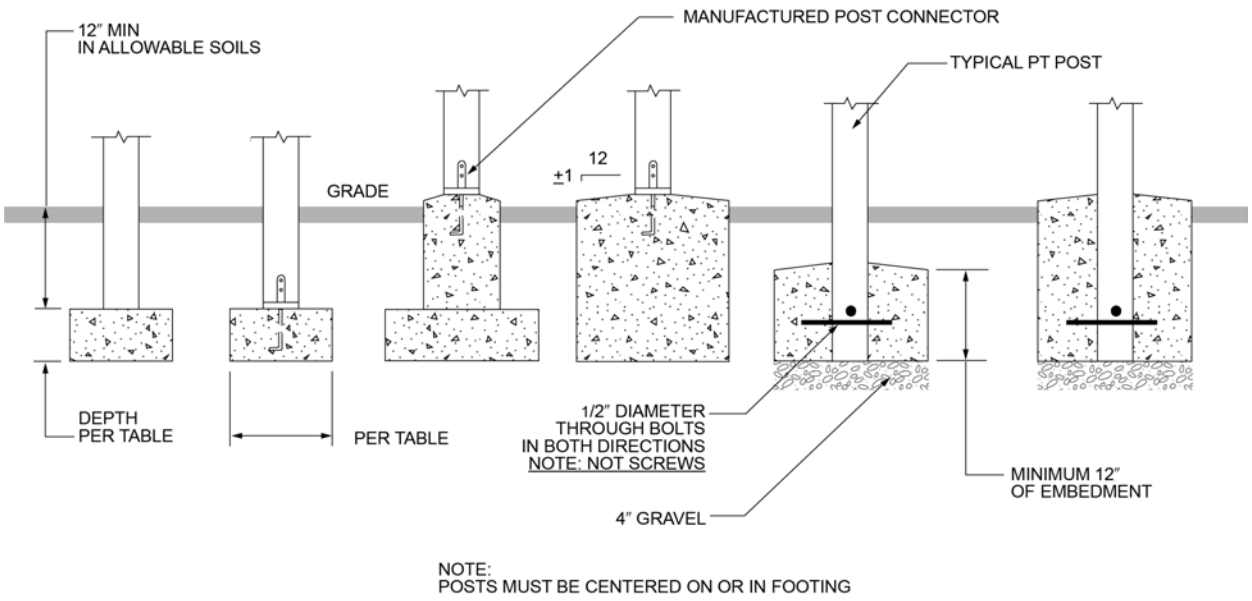
1. Walls enclosing the under-floor space shall be provided with flood openings in accordance with Section R322.2.2.
2. The finished ground level of the under-floor space shall be equal to or higher than the outside finished ground level on at least one side.

Exception: Under-floor spaces that meet the requirements of FEMA TB 11-1.

[W] R408.8 Under-floor vapor retarder. ((~~In Climate Zones 1A, 2A and 3A below the warm-humid line, a continuous Class I or II vapor retarder shall be provided on the exposed face of air-permeable insulation installed between the floor joists and exposed to the grade in the under-floor space. The vapor retarder shall have a maximum water vapor permeance of 1.5 perms when tested in accordance with Procedure B of ASTM E96.~~

~~**Exception:** The vapor retarder shall not be required in unvented *crawl spaces* constructed in accordance with Section R408.3.~~)) This section is not adopted.

FLOORS



For SI: 1 inch = 25.4 mm.

FIGURE R507.3
DECK POSTS TO DECK FOOTING CONNECTION

R507.3.1 Minimum size. The minimum size of concrete footings shall be in accordance with Table R507.3.1, based on the tributary area and allowable soil-bearing pressure in accordance with Table R401.4.1.

[W] ((~~TABLE R507.3.1~~
~~MINIMUM FOOTING SIZE FOR DECKS~~

~~LIVE OR GROUND SNOW LOAD[b] (psf)~~	~~TRIBUTARY AREA (ft^2)~~	~~LOAD-BEARING VALUE OF SOILS[a, c, d] (psf)~~								
		~~1,500[e]~~			~~2,000[e]~~			~~≥ 3,000[e]~~		
		~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~
~~40~~	~~5~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~10~~	~~12~~	~~6~~	~~9~~	~~9~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~40~~	~~14~~	~~16~~	~~6~~	~~12~~	~~14~~	~~6~~	~~10~~	~~12~~	~~6~~
	~~60~~	~~17~~	~~19~~	~~6~~	~~15~~	~~17~~	~~6~~	~~12~~	~~14~~	~~6~~
	~~80~~	~~20~~	~~22~~	~~7~~	~~17~~	~~19~~	~~6~~	~~14~~	~~16~~	~~6~~
	~~100~~	~~22~~	~~25~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~120~~	~~24~~	~~27~~	~~9~~	~~21~~	~~23~~	~~7~~	~~17~~	~~19~~	~~6~~
	~~140~~	~~26~~	~~29~~	~~10~~	~~22~~	~~25~~	~~8~~	~~18~~	~~21~~	~~6~~
	~~160~~	~~28~~	~~31~~	~~11~~	~~24~~	~~27~~	~~9~~	~~20~~	~~22~~	~~7~~
~~50~~	~~5~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~11~~	~~13~~	~~6~~	~~10~~	~~11~~	~~6~~	~~8~~	~~9~~	~~6~~
	~~40~~	~~15~~	~~17~~	~~6~~	~~13~~	~~15~~	~~6~~	~~11~~	~~13~~	~~6~~
	~~60~~	~~19~~	~~21~~	~~6~~	~~16~~	~~18~~	~~6~~	~~13~~	~~15~~	~~6~~
	~~80~~	~~21~~	~~24~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~100~~	~~24~~	~~27~~	~~9~~	~~21~~	~~23~~	~~7~~	~~17~~	~~19~~	~~6~~
	~~120~~	~~26~~	~~30~~	~~10~~	~~23~~	~~26~~	~~8~~	~~19~~	~~21~~	~~6~~
	~~140~~	~~28~~	~~32~~	~~11~~	~~25~~	~~28~~	~~9~~	~~20~~	~~23~~	~~7~~
	~~160~~	~~30~~	~~34~~	~~12~~	~~26~~	~~30~~	~~10~~	~~21~~	~~24~~	~~8~~

~~[W] ((TABLE R507.3.1—continued~~
~~MINIMUM FOOTING SIZE FOR DECKS~~

~~LIVE OR GROUND SNOW LOAD[b] (psf)~~	~~TRIBUTARY AREA (ft^2)~~	~~LOAD BEARING VALUE OF SOILS[a, c, d] (psf)~~								
		~~1,500[e]~~			~~2,000[e]~~			~~≥ 3,000[e]~~		
		~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)[f]~~
~~60~~	~~5~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~12~~	~~14~~	~~6~~	~~11~~	~~12~~	~~6~~	~~9~~	~~10~~	~~6~~
	~~40~~	~~16~~	~~19~~	~~6~~	~~14~~	~~16~~	~~8~~	~~12~~	~~14~~	~~6~~
	~~60~~	~~20~~	~~23~~	~~7~~	~~17~~	~~20~~	~~6~~	~~14~~	~~16~~	~~6~~
	~~80~~	~~23~~	~~26~~	~~9~~	~~20~~	~~23~~	~~7~~	~~16~~	~~19~~	~~6~~
	~~100~~	~~26~~	~~29~~	~~10~~	~~22~~	~~25~~	~~8~~	~~18~~	~~21~~	~~6~~
	~~120~~	~~28~~	~~32~~	~~11~~	~~25~~	~~28~~	~~9~~	~~20~~	~~23~~	~~7~~
	~~140~~	~~31~~	~~35~~	~~12~~	~~27~~	~~30~~	~~10~~	~~22~~	~~24~~	~~8~~
	~~160~~	~~33~~	~~37~~	~~13~~	~~28~~	~~32~~	~~11~~	~~23~~	~~26~~	~~9~~
~~70~~	~~5~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~12~~	~~14~~	~~6~~	~~11~~	~~13~~	~~6~~	~~9~~	~~10~~	~~6~~
	~~40~~	~~18~~	~~20~~	~~6~~	~~15~~	~~17~~	~~6~~	~~12~~	~~14~~	~~6~~
	~~60~~	~~21~~	~~24~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~80~~	~~25~~	~~28~~	~~9~~	~~21~~	~~24~~	~~8~~	~~18~~	~~20~~	~~6~~
	~~100~~	~~28~~	~~31~~	~~11~~	~~24~~	~~27~~	~~9~~	~~20~~	~~22~~	~~7~~
	~~120~~	~~30~~	~~34~~	~~12~~	~~26~~	~~30~~	~~10~~	~~21~~	~~24~~	~~8~~
	~~140~~	~~33~~	~~37~~	~~13~~	~~28~~	~~32~~	~~11~~	~~23~~	~~26~~	~~9~~
	~~160~~	~~35~~	~~40~~	~~15~~	~~30~~	~~34~~	~~12~~	~~25~~	~~28~~	~~9~~

~~For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.~~

~~a. Interpolation permitted, extrapolation not permitted.~~

~~b. Based on highest load case: Dead + Live or Dead + Snow.~~

~~c. Footing dimensions shall allow complete bearing of the post.~~

~~d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.~~

~~e. Area, in square feet, of deck surface supported by post and footings.~~

~~f. Minimum thickness shall only apply to plain concrete footings.~~))

[W] TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD (psf)	TRIBUTARY AREA[e] (sq. ft.)	SOIL BEARING CAPACITY[a, c, d]								
		1500 psf			2000 psf			≥ 3000 psf		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)
60 live load or 70 ground snow load	5	7	8	6	7	8	6	7	8	6
	20	12	14	6	11	13	6	9	10	6
	40	18	20	6	15	17	6	12	14	6
	60	21	24	8	19	21	6	15	17	6
	80	25	28	9	21	24	8	18	20	6
	100	28	31	11	24	27	9	20	22	7
	120	30	34	12	26	30	10	21	24	8
	140	33	37	13	28	32	11	23	26	9
	160	35	40	15	30	34	12	25	28	9

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.

b. Reserved.

c. Footing dimensions shall allow complete bearing of the post.

d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.

e. Area, in square feet, of deck surface supported by post and footings.

f. Minimum thickness shall only apply to plain concrete footings.

R507.3.2 Minimum depth. Deck footings shall be placed not less than 12 inches (305 mm) below the undisturbed ground surface.

R507.3.3 Frost protection. Where decks are attached to a frost-protected structure, deck footings shall be protected from frost by one or more of the following methods:

1. Extending below the frost line specified in Table R301.2.
2. Erecting on solid rock.
3. Other *approved* methods of frost protection.

R507.4 Deck posts. For single-level decks, wood post size shall be in accordance with Table R507.4.

R507.4.1 Deck post to deck footing connection. Where posts bear on concrete footings in accordance with Section R403 and Figure R507.3, lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12 inches (305 mm) in surrounding soils or concrete piers. Other footing systems shall be permitted.

Exception: Where expansive, compressible, shifting or other questionable soils are present, surrounding soils shall not be relied on for lateral support.

[W] ((~~TABLE R507.4 DECK POST HEIGHT~~

~~LOADS (psf)[b]~~	~~POST SPECIES[c]~~	~~POST SIZE[d]~~	~~TRIBUTARY AREA (ft²)[g, h]~~							
			~~20~~	~~40~~	~~60~~	~~80~~	~~100~~	~~120~~	~~140~~	~~160~~
			~~MAXIMUM DECK POST HEIGHT[a] (feet inches)~~							
~~40 live load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~13-8~~	~~11-0~~	~~9-5~~	~~8-4~~	~~7-5~~	~~6-9~~	~~6-2~~
		~~4× 6~~	~~14-0~~	~~14-0~~	~~13-11~~	~~12-0~~	~~10-8~~	~~9-8~~	~~8-10~~	~~8-2~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~13-6~~	~~10-10~~	~~9-3~~	~~8-0~~	~~7-0~~	~~6-2~~	~~5-3~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~13-10~~	~~11-10~~	~~10-6~~	~~9-5~~	~~8-7~~	~~7-10~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~4 × 4~~	~~14-0~~	~~13-2~~	~~10-3~~	~~8-1~~	~~5-8~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~13-6~~	~~11-4~~	~~9-9~~	~~8-4~~	~~6-9~~	~~4-7~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~13-7~~	~~9-7~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
~~50 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~12-2~~	~~9-10~~	~~8-5~~	~~7-5~~	~~6-7~~	~~5-11~~	~~5-4~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-6~~	~~10-9~~	~~9-6~~	~~8-7~~	~~7-10~~	~~7-3~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~13-4~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~12-1~~	~~9-8~~	~~8-2~~	~~7-1~~	~~6-2~~	~~5-3~~	~~4-2~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-4~~	~~10-7~~	~~9-4~~	~~8-4~~	~~7-7~~	~~6-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-10~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~4 × 4~~	~~14-0~~	~~11-8~~	~~9-0~~	~~6-10~~	~~3-7~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-0~~	~~10-0~~	~~8-6~~	~~7-0~~	~~5-3~~	~~NP~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~10-8~~	~~2-4~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~

[W] ((~~TABLE R507.4—continued~~
~~DECK POST HEIGHT~~

~~LOADS (psf)[b]~~	~~POST SPECIES[c]~~	~~POST SIZE[d]~~	~~TRIBUTARY AREA (ft²)[g,h]~~							
			~~20~~	~~40~~	~~60~~	~~80~~	~~100~~	~~120~~	~~140~~	~~160~~
			~~MAXIMUM DECK POST HEIGHT[a] (feet-inches)~~							
~~60 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~11-1~~	~~8-11~~	~~7-7~~	~~6-7~~	~~5-10~~	~~5-2~~	~~4-6~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~11-4~~	~~9-9~~	~~8-7~~	~~7-9~~	~~7-1~~	~~6-6~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-9~~	~~11-2~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~10-11~~	~~8-8~~	~~7-3~~	~~6-2~~	~~5-0~~	~~3-7~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~13-11~~	~~11-2~~	~~9-7~~	~~8-4~~	~~7-5~~	~~6-8~~	~~5-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-2~~	~~10-2~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~4 × 4~~	~~14-0~~	~~10-6~~	~~7-9~~	~~4-7~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~13-7~~	~~10-9~~	~~8-9~~	~~7-0~~	~~4-9~~	~~NP~~	~~NP~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~9-9~~	~~NP~~	~~NP~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
~~70 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~10-2~~	~~8-2~~	~~6-11~~	~~5-11~~	~~5-2~~	~~4-4~~	~~3-4~~
		~~4 × 6~~	~~14-0~~	~~12-11~~	~~10-5~~	~~8-11~~	~~7-10~~	~~7-1~~	~~6-5~~	~~5-10~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-9~~	~~10-11~~	~~8-7~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~10-1~~	~~7-11~~	~~6-6~~	~~5-3~~	~~3-7~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~12-10~~	~~10-3~~	~~8-9~~	~~7-7~~	~~6-8~~	~~5-10~~	~~4-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-2~~	~~9-9~~	~~5-9~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~4 × 4~~	~~14-0~~	~~9-5~~	~~6-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~12-6~~	~~9-8~~	~~7-7~~	~~5-3~~	~~NP~~	~~NP~~	~~NP~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~10-8~~	~~NP~~	~~NP~~	~~NP~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~NP = Not Permitted.~~

~~a. Measured from the underside of the beam to the top of footing or pier.~~

~~b. 10 psf dead load. Snow load not assumed to be concurrent with live load.~~

~~c. No. 2 grade, wet service factor included.~~

~~d. Notched deck posts shall be sized to accommodate beam size in accordance with Section R507.5.2.~~

~~e. Includes incising factor.~~

~~f. Incising factor not included.~~

~~g. Area, in square feet, of deck surface supported by post and footings.~~

~~h. Interpolation permitted. Extrapolation not permitted.~~))

[W] TABLE R507.4
DECK POST HEIGHT

LOADS[b] (psf)	POST SPECIES[c]	POST SIZE[d]	MAXIMUM DECK POST HEIGHT[a] (feet-inches)							
			TRIBUTARY AREA[g,h] (sq ft)							
			20	40	60	80	100	120	140	160
60 Live Load, ≤ 60 Ground Snow Load	Douglas Fir[e], Hem-fir[e], SPF[e]	4 × 4	14-0	10-10	8-7	7-0	5-8	4-1	NP	NP
		4 × 6	14-0	13-10	11-1	9-5	8-2	7-3	6-4	5-4
		6 × 6	14-0	14-0	14-0	14-0	14-0	13-3	10-9	6-11
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	4 × 4	14-0	10-3	7-0	NP	NP	NP	NP	NP
		4 × 6	14-0	13-6	10-6	8-4	5-10	NP	NP	NP
		6 × 6	14-0	14-0	14-0	14-0	11-11	NP	NP	NP
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

FLOORS

[W] TABLE R507.4—continued
DECK POST HEIGHT

LOADS[b] (psf)	POST SPECIES[c]	POST SIZE[d]	MAXIMUM DECK POST HEIGHT[a] (feet-inches)							
			TRIBUTARY AREA[a, h] (sq ft)							
			20	40	60	80	100	120	140	160
70 Ground Snow Load	Douglas Fir[e], Hem-fir[e], SPF[e]	4 × 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
		4 × 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
		6 × 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	4 × 4	14-0	9-5	6-5	NP	NP	NP	NP	NP
		4 × 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP
		6 × 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 psf = 0.0479 kPa. NP = Not Permitted

a. Measured from the underside of the beam to top of footing or pier.
b. Ten psf dead load. Snow load not assumed to be concurrent with live load.
c. No. 2 grade, wet service factor included.
d. Notched deck posts shall be sized to accommodate beam size in accordance with Section R507.5.2.
e. Includes incising factor.
f. Incising factor not included.
g. Area, in square feet, of deck surface supported by post and footings.
h. Interpolation permitted. Extrapolation is not permitted.

[W] R507.5 Deck beams. Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with ((~~Tables R507.5(1) through R507.5(4)~~)) Table R507.5. Beam plies shall be fastened together with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the actual beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.

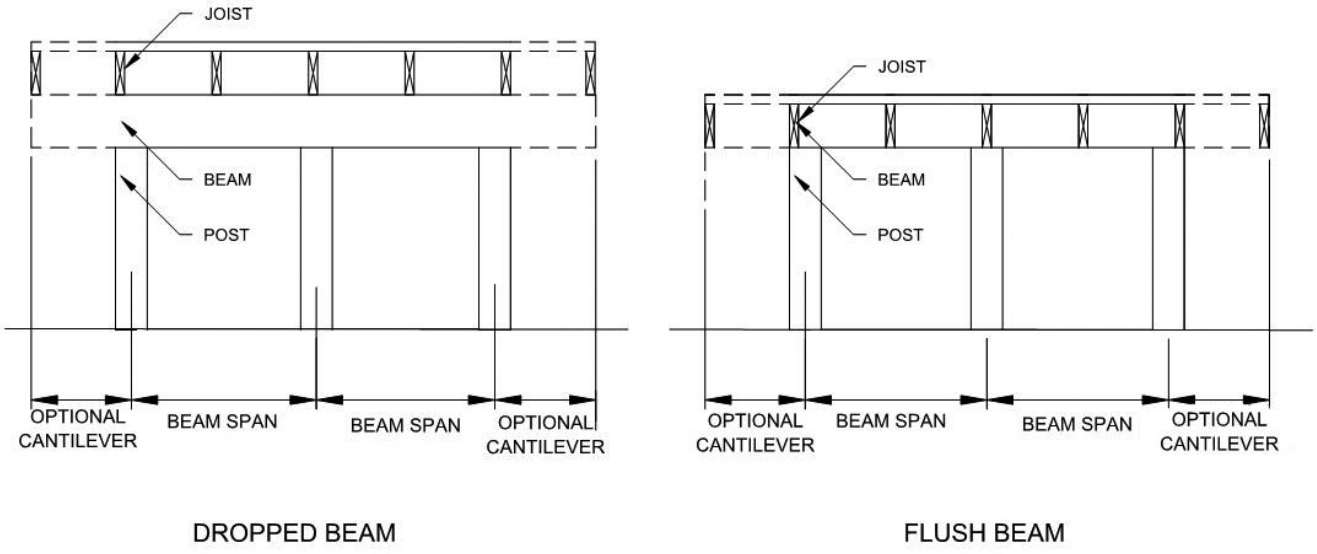


FIGURE R507.5
TYPICAL DECK ((~~JOIST~~)) BEAM SPANS

[W] ((~~TABLE R507.5(1)~~
~~MAXIMUM DECK BEAM SPAN – 40 PSF LIVE LOAD~~[c]

~~BEAM SPECIES~~[d]	~~BEAM SIZE~~[e]	~~EFFECTIVE DECK JOIST SPAN LENGTH~~[a, i, j] ~~(feet)~~						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)~~[a, b, f]						
~~Southern pine~~	~~1 – 2 × 6~~	~~4-7~~	~~4-0~~	~~3-7~~	~~3-3~~	~~3-0~~	~~2-10~~	~~2-8~~
	~~1 – 2 × 8~~	~~5-11~~	~~5-1~~	~~4-7~~	~~4-2~~	~~3-10~~	~~3-7~~	~~3-5~~
	~~1 – 2 × 10~~	~~7-0~~	~~6-0~~	~~5-5~~	~~4-11~~	~~4-7~~	~~4-3~~	~~4-0~~
	~~1 – 2 × 12~~	~~8-3~~	~~7-1~~	~~6-4~~	~~5-10~~	~~5-5~~	~~5-0~~	~~4-9~~
	~~2 – 2 × 6~~	~~6-11~~	~~5-11~~	~~5-4~~	~~4-10~~	~~4-6~~	~~4-3~~	~~4-0~~
	~~2 – 2 × 8~~	~~8-9~~	~~7-7~~	~~6-9~~	~~6-2~~	~~5-9~~	~~5-4~~	~~5-0~~
	~~2 – 2 × 10~~	~~10-4~~	~~9-0~~	~~8-0~~	~~7-4~~	~~6-9~~	~~6-4~~	~~6-0~~
	~~2 – 2 × 12~~	~~12-2~~	~~10-7~~	~~9-5~~	~~8-7~~	~~8-0~~	~~7-5~~	~~7-0~~
	~~3 – 2 × 6~~	~~8-6~~	~~7-5~~	~~6-8~~	~~6-1~~	~~5-8~~	~~5-3~~	~~4-11~~
	~~3 – 2 × 8~~	~~10-11~~	~~9-6~~	~~8-6~~	~~7-9~~	~~7-2~~	~~6-8~~	~~6-4~~
	~~3 – 2 × 10~~	~~13-0~~	~~11-2~~	~~10-0~~	~~9-2~~	~~8-6~~	~~7-11~~	~~7-6~~
	~~3 – 2 × 12~~	~~15-3~~	~~13-3~~	~~11-10~~	~~10-9~~	~~10-0~~	~~9-4~~	~~8-10~~
~~Douglas fir-larch~~[g] ~~Hem-fir~~[g] ~~Spruce-pine-fir~~	~~1 – 2 × 6~~	~~4-1~~	~~3-6~~	~~3-0~~	~~2-8~~	~~2-5~~	~~2-3~~	~~2-1~~
	~~1 – 2 × 8~~	~~5-6~~	~~4-8~~	~~4-0~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-9~~
	~~1 – 2 × 10~~	~~6-8~~	~~5-10~~	~~5-1~~	~~4-6~~	~~4-1~~	~~3-9~~	~~3-6~~
	~~1 – 2 × 12~~	~~7-9~~	~~6-9~~	~~6-0~~	~~5-6~~	~~5-0~~	~~3-9~~	~~3-6~~
	~~2 – 2 × 6~~	~~6-1~~	~~5-3~~	~~4-9~~	~~4-4~~	~~3-11~~	~~3-7~~	~~3-3~~
	~~2 – 2 × 8~~	~~8-2~~	~~7-1~~	~~6-4~~	~~5-9~~	~~5-2~~	~~4-8~~	~~4-4~~
	~~2 – 2 × 10~~	~~10-0~~	~~8-7~~	~~7-9~~	~~7-0~~	~~6-6~~	~~6-0~~	~~5-6~~
	~~2 – 2 × 12~~	~~11-7~~	~~10-0~~	~~8-11~~	~~8-2~~	~~7-7~~	~~7-1~~	~~6-8~~
	~~3 – 2 × 6~~	~~7-8~~	~~6-8~~	~~6-0~~	~~5-6~~	~~5-1~~	~~4-9~~	~~4-6~~
	~~3 – 2 × 8~~	~~10-3~~	~~8-10~~	~~7-11~~	~~7-3~~	~~6-8~~	~~6-3~~	~~5-11~~
	~~3 – 2 × 10~~	~~12-6~~	~~10-10~~	~~9-8~~	~~8-10~~	~~8-2~~	~~7-8~~	~~7-2~~
	~~3 – 2 × 12~~	~~14-6~~	~~12-7~~	~~11-3~~	~~10-3~~	~~9-6~~	~~8-11~~	~~8-5~~
~~Redwood~~[h] ~~Western cedars~~[h] ~~Ponderosa pine~~[h] ~~Red pine~~[h]	~~1 – 2 × 6~~	~~4-2~~	~~3-7~~	~~3-1~~	~~2-9~~	~~2-6~~	~~2-3~~	~~2-2~~
	~~1 – 2 × 8~~	~~5-4~~	~~4-7~~	~~4-1~~	~~3-7~~	~~3-3~~	~~3-0~~	~~2-10~~
	~~1 – 2 × 10~~	~~6-6~~	~~5-7~~	~~5-0~~	~~4-7~~	~~4-2~~	~~3-10~~	~~3-7~~
	~~1 – 2 × 12~~	~~7-6~~	~~6-6~~	~~5-10~~	~~5-4~~	~~4-11~~	~~4-7~~	~~4-4~~
	~~2 – 2 × 6~~	~~6-2~~	~~5-4~~	~~4-10~~	~~4-5~~	~~4-0~~	~~3-8~~	~~3-4~~
	~~2 – 2 × 8~~	~~7-10~~	~~6-10~~	~~6-1~~	~~5-7~~	~~5-2~~	~~4-10~~	~~4-5~~
	~~2 – 2 × 10~~	~~9-7~~	~~8-4~~	~~7-5~~	~~6-9~~	~~6-3~~	~~5-10~~	~~5-6~~
	~~2 – 2 × 12~~	~~11-1~~	~~9-8~~	~~8-7~~	~~7-10~~	~~7-3~~	~~6-10~~	~~6-5~~
	~~3 – 2 × 6~~	~~7-8~~	~~6-9~~	~~6-0~~	~~5-6~~	~~5-1~~	~~4-9~~	~~4-6~~
	~~3 – 2 × 8~~	~~9-10~~	~~8-6~~	~~7-7~~	~~6-11~~	~~6-5~~	~~6-0~~	~~5-8~~
	~~3 – 2 × 10~~	~~12-0~~	~~10-5~~	~~9-4~~	~~8-6~~	~~7-10~~	~~7-4~~	~~6-11~~
	~~3 – 2 × 12~~	~~13-11~~	~~12-1~~	~~10-9~~	~~9-10~~	~~9-1~~	~~8-6~~	~~8-1~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation permitted. Extrapolation not permitted.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load is not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~))

FLOORS

[W] ((~~TABLE R507.5(2)~~
~~MAXIMUM DECK BEAM SPAN – 50 PSF GROUND SNOW LOAD~~[c]

~~BEAM SPECIES~~[d]	~~BEAM SIZE~~[e]	~~EFFECTIVE DECK JOIST SPAN LENGTH (feet)~~[a, i, j]						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)~~[a, b, f]						
~~Southern pine~~	~~1 – 2 × 6~~	~~4-6~~	~~3-11~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-9~~	~~2-7~~
	~~1 – 2 × 8~~	~~5-9~~	~~4-11~~	~~4-5~~	~~4-0~~	~~3-9~~	~~3-6~~	~~3-3~~
	~~1 – 2 × 10~~	~~6-9~~	~~5-10~~	~~5-3~~	~~4-9~~	~~4-5~~	~~4-2~~	~~3-11~~
	~~1 – 2 × 12~~	~~8-0~~	~~6-11~~	~~6-2~~	~~5-8~~	~~5-3~~	~~4-11~~	~~4-7~~
	~~2 – 2 × 6~~	~~6-8~~	~~5-9~~	~~5-2~~	~~4-9~~	~~4-4~~	~~4-1~~	~~3-10~~
	~~2 – 2 × 8~~	~~8-6~~	~~7-4~~	~~6-7~~	~~6-0~~	~~5-7~~	~~5-2~~	~~4-11~~
	~~2 – 2 × 10~~	~~10-1~~	~~8-9~~	~~7-10~~	~~7-1~~	~~6-7~~	~~6-2~~	~~5-10~~
	~~2 – 2 × 12~~	~~11-11~~	~~10-3~~	~~9-2~~	~~8-5~~	~~7-9~~	~~7-3~~	~~6-10~~
	~~3 – 2 × 6~~	~~7-11~~	~~7-2~~	~~6-6~~	~~5-11~~	~~5-6~~	~~5-1~~	~~4-10~~
	~~3 – 2 × 8~~	~~10-5~~	~~9-3~~	~~8-3~~	~~7-6~~	~~6-11~~	~~6-6~~	~~6-2~~
	~~3 – 2 × 10~~	~~12-8~~	~~10-11~~	~~9-9~~	~~8-11~~	~~8-3~~	~~7-9~~	~~7-3~~
	~~3 – 2 × 12~~	~~14-11~~	~~12-11~~	~~11-6~~	~~10-6~~	~~9-9~~	~~9-1~~	~~8-7~~
~~Douglas fir-larch~~[g] ~~Hem-fir~~[g] ~~Spruce-pine-fir~~[g]	~~1 – 2 × 6~~	~~4-0~~	~~3-5~~	~~2-11~~	~~2-7~~	~~2-4~~	~~2-2~~	~~2-0~~
	~~1 – 2 × 8~~	~~5-4~~	~~4-7~~	~~3-11~~	~~3-5~~	~~3-1~~	~~2-10~~	~~2-8~~
	~~1 – 2 × 10~~	~~6-7~~	~~5-8~~	~~4-11~~	~~4-5~~	~~4-0~~	~~3-8~~	~~3-5~~
	~~1 – 2 × 12~~	~~7-7~~	~~6-7~~	~~5-11~~	~~5-4~~	~~4-10~~	~~4-6~~	~~4-2~~
	~~2 – 2 × 6~~	~~6-0~~	~~5-2~~	~~4-7~~	~~4-2~~	~~3-10~~	~~3-5~~	~~3-2~~
	~~2 – 2 × 8~~	~~8-0~~	~~6-11~~	~~6-2~~	~~5-8~~	~~5-0~~	~~4-7~~	~~4-2~~
	~~2 – 2 × 10~~	~~9-9~~	~~8-5~~	~~7-7~~	~~6-11~~	~~6-4~~	~~5-10~~	~~5-4~~
	~~2 – 2 × 12~~	~~11-4~~	~~9-10~~	~~8-9~~	~~8-0~~	~~7-5~~	~~6-11~~	~~6-6~~
	~~3 – 2 × 6~~	~~7-6~~	~~6-6~~	~~5-9~~	~~5-3~~	~~4-11~~	~~4-7~~	~~4-4~~
	~~3 – 2 × 8~~	~~10-0~~	~~8-8~~	~~7-9~~	~~7-1~~	~~6-6~~	~~6-1~~	~~5-8~~
	~~3 – 2 × 10~~	~~12-3~~	~~10-7~~	~~9-6~~	~~8-8~~	~~8-0~~	~~7-6~~	~~7-0~~
	~~3 – 2 × 12~~	~~14-3~~	~~12-4~~	~~11-0~~	~~10-1~~	~~9-4~~	~~8-9~~	~~8-3~~
~~Redwood~~[h] ~~Western cedars~~[h] ~~Ponderosa pine~~[h] ~~Red pine~~[h]	~~1 – 2 × 6~~	~~4-1~~	~~3-6~~	~~3-0~~	~~2-8~~	~~2-5~~	~~2-3~~	~~2-1~~
	~~1 – 2 × 8~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-9~~
	~~1 – 2 × 10~~	~~6-4~~	~~5-6~~	~~4-11~~	~~4-6~~	~~4-1~~	~~3-9~~	~~3-6~~
	~~1 – 2 × 12~~	~~7-4~~	~~6-4~~	~~5-8~~	~~5-2~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2 – 2 × 6~~	~~6-1~~	~~5-3~~	~~4-8~~	~~4-4~~	~~3-11~~	~~3-6~~	~~3-3~~
	~~2 – 2 × 8~~	~~7-8~~	~~6-8~~	~~5-11~~	~~5-5~~	~~5-0~~	~~4-8~~	~~4-3~~
	~~2 – 2 × 10~~	~~9-5~~	~~8-2~~	~~7-3~~	~~6-8~~	~~6-2~~	~~5-9~~	~~5-5~~
	~~2 – 2 × 12~~	~~10-11~~	~~9-5~~	~~8-5~~	~~7-8~~	~~7-2~~	~~6-8~~	~~6-3~~
	~~3 – 2 × 6~~	~~7-1~~	~~6-5~~	~~5-11~~	~~5-5~~	~~5-0~~	~~4-8~~	~~4-5~~
	~~3 – 2 × 8~~	~~9-4~~	~~8-4~~	~~7-5~~	~~6-10~~	~~604~~	~~5-11~~	~~5-7~~
	~~3 – 2 × 10~~	~~11-9~~	~~10-2~~	~~9-1~~	~~8-4~~	~~7-8~~	~~7-2~~	~~6-9~~
	~~3 – 2 × 12~~	~~13-8~~	~~11-10~~	~~10-7~~	~~9-8~~	~~8-11~~	~~8-4~~	~~7-10~~

~~For SI: 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~))

[W] ((~~TABLE R507.5(3)~~
~~MAXIMUM DECK BEAM SPAN – 60 PSF GROUND SNOW LOAD~~[e]

~~BEAM SPECIES~~[d]	~~BEAM SIZE~~[e]	~~EFFECTIVE DECK JOIST SPAN LENGTH~~[a, i, j] ~~(feet)~~						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet inches)~~[a, b, f]						
~~Southern pine~~	~~1 – 2 × 6~~	~~4-2~~	~~3-7~~	~~3-3~~	~~2-11~~	~~2-9~~	~~2-6~~	~~2-5~~
	~~1 – 2 × 8~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-9~~	~~3-5~~	~~3-3~~	~~3-0~~
	~~1 – 2 × 10~~	~~6-3~~	~~5-5~~	~~4-10~~	~~4-5~~	~~4-1~~	~~3-10~~	~~3-7~~
	~~1 – 2 × 12~~	~~7-5~~	~~6-5~~	~~5-9~~	~~5-3~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2 – 2 × 6~~	~~6-2~~	~~5-4~~	~~4-9~~	~~4-4~~	~~4-0~~	~~3-9~~	~~3-7~~
	~~2 – 2 × 8~~	~~7-10~~	~~6-10~~	~~6-1~~	~~5-7~~	~~5-2~~	~~4-10~~	~~4-6~~
	~~2 – 2 × 10~~	~~9-4~~	~~8-1~~	~~7-3~~	~~6-7~~	~~6-1~~	~~5-8~~	~~5-4~~
	~~2 – 2 × 12~~	~~11-0~~	~~9-6~~	~~8-6~~	~~7-9~~	~~7-2~~	~~6-9~~	~~6-4~~
	~~3 – 2 × 6~~	~~7-5~~	~~6-9~~	~~6-0~~	~~5-6~~	~~5-1~~	~~4-9~~	~~4-6~~
	~~3 – 2 × 8~~	~~9-9~~	~~8-6~~	~~7-8~~	~~6-11~~	~~6-5~~	~~6-0~~	~~5-8~~
	~~3 – 2 × 10~~	~~11-8~~	~~10-2~~	~~9-1~~	~~8-3~~	~~7-8~~	~~7-2~~	~~6-9~~
	~~3 – 2 × 12~~	~~13-9~~	~~11-11~~	~~10-8~~	~~9-9~~	~~9-0~~	~~8-5~~	~~7-11~~
~~Douglas fir-larch~~[g] ~~Hem-fir~~[g] ~~Spuce-pine-fir~~[g]	~~1 – 2 × 6~~	~~3-8~~	~~3-1~~	~~2-8~~	~~2-4~~	~~2-2~~	~~2-0~~	~~1-10~~
	~~1 – 2 × 8~~	~~5-0~~	~~4-1~~	~~3-6~~	~~3-1~~	~~2-10~~	~~2-7~~	~~2-5~~
	~~1 – 2 × 10~~	~~6-1~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-7~~	~~3-4~~	~~3-2~~
	~~1 – 2 × 12~~	~~7-1~~	~~6-1~~	~~5-5~~	~~4-10~~	~~4-5~~	~~4-1~~	~~3-10~~
	~~2 – 2 × 6~~	~~5-6~~	~~4-9~~	~~4-3~~	~~3-10~~	~~3-5~~	~~3-1~~	~~2-10~~
	~~2 – 2 × 8~~	~~7-5~~	~~6-5~~	~~5-9~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-9~~
	~~2 – 2 × 10~~	~~9-0~~	~~7-10~~	~~7-0~~	~~6-4~~	~~5-9~~	~~5-2~~	~~4-10~~
	~~2 – 2 × 12~~	~~10-6~~	~~9-1~~	~~8-1~~	~~7-5~~	~~6-10~~	~~6-4~~	~~5-10~~
	~~3 – 2 × 6~~	~~6-11~~	~~6-0~~	~~5-4~~	~~4-11~~	~~4-6~~	~~4-2~~	~~3-10~~
	~~3 – 2 × 8~~	~~9-3~~	~~8-0~~	~~7-2~~	~~6-6~~	~~6-1~~	~~5-6~~	~~5-0~~
	~~3 – 2 × 10~~	~~11-4~~	~~9-10~~	~~8-9~~	~~8-0~~	~~7-5~~	~~6-11~~	~~6-5~~
	~~3 – 2 × 12~~	~~13-2~~	~~11-5~~	~~10-2~~	~~9-4~~	~~8-7~~	~~8-1~~	~~7-7~~
~~Redwood~~[h] ~~Western cedars~~[h] ~~Ponderosa pine~~[h] ~~Red pine~~[h]	~~1 – 2 × 6~~	~~3-9~~	~~3-2~~	~~2-9~~	~~2-5~~	~~2-2~~	~~2-0~~	~~1-11~~
	~~1 – 2 × 8~~	~~4-10~~	~~4-2~~	~~3-7~~	~~3-2~~	~~2-11~~	~~2-8~~	~~2-6~~
	~~1 – 2 × 10~~	~~5-10~~	~~5-1~~	~~4-6~~	~~4-1~~	~~3-8~~	~~3-5~~	~~3-3~~
	~~1 – 2 × 12~~	~~6-10~~	~~5-11~~	~~5-3~~	~~4-10~~	~~4-5~~	~~4-2~~	~~3-11~~
	~~2 – 2 × 6~~	~~5-7~~	~~4-10~~	~~4-4~~	~~3-11~~	~~3-6~~	~~3-2~~	~~2-11~~
	~~2 – 2 × 8~~	~~7-1~~	~~6-2~~	~~5-6~~	~~5-0~~	~~4-7~~	~~4-2~~	~~3-10~~
	~~2 – 2 × 10~~	~~8-8~~	~~7-6~~	~~6-9~~	~~6-2~~	~~5-8~~	~~5-4~~	~~4-11~~
	~~2 – 2 × 12~~	~~10-1~~	~~8-9~~	~~7-10~~	~~7-2~~	~~6-7~~	~~6-2~~	~~5-10~~
	~~3 – 2 × 6~~	~~6-8~~	~~6-1~~	~~5-5~~	~~5-0~~	~~4-7~~	~~4-3~~	~~3-11~~
	~~3 – 2 × 8~~	~~8-9~~	~~7-9~~	~~6-22~~	~~6-4~~	~~5-20~~	~~5-5~~	~~5-3~~
	~~3 – 2 × 10~~	~~10-11~~	~~9-5~~	~~8-5~~	~~7-8~~	~~7-3~~	~~6-8~~	~~6-3~~
	~~3 – 2 × 12~~	~~12-8~~	~~10-11~~	~~9-9~~	~~8-11~~	~~8-3~~	~~7-9~~	~~7-3~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~))

FLOORS

[W] ((~~TABLE R507.5(4)~~
~~MAXIMUM DECK BEAM SPAN – 70 PSF GROUND SNOW LOAD~~[c]

~~BEAM SPECIES~~[d]	~~BEAM SIZE~~[e]	~~EFFECTIVE DECK JOIST SPAN LENGTH (feet)~~[a, i, j]						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)~~[a, b, f]						
~~Southern pine~~	~~1 – 2 × 6~~	~~3-11~~	~~3-4~~	~~3-0~~	~~2-9~~	~~2-6~~	~~2-4~~	~~2-3~~
	~~1 – 2 × 8~~	~~4-11~~	~~4-3~~	~~3-10~~	~~3-6~~	~~3-3~~	~~3-0~~	~~2-10~~
	~~1 – 2 × 10~~	~~5-10~~	~~5-1~~	~~4-6~~	~~4-2~~	~~3-10~~	~~3-7~~	~~3-4~~
	~~1 – 2 × 12~~	~~6-11~~	~~6-0~~	~~5-4~~	~~4-11~~	~~4-6~~	~~4-3~~	~~4-0~~
	~~2 – 2 × 6~~	~~5-9~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-9~~	~~3-6~~	~~3-4~~
	~~2 – 2 × 8~~	~~7-4~~	~~6-4~~	~~5-8~~	~~5-2~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2 – 2 × 10~~	~~8-9~~	~~7-7~~	~~6-9~~	~~6-2~~	~~5-8~~	~~5-4~~	~~5-0~~
	~~2 – 2 × 12~~	~~10-3~~	~~8-11~~	~~8-0~~	~~7-3~~	~~6-9~~	~~6-3~~	~~5-11~~
	~~3 – 2 × 6~~	~~7-0~~	~~6-3~~	~~5-7~~	~~5-1~~	~~4-9~~	~~4-5~~	~~4-2~~
	~~3 – 2 × 8~~	~~9-3~~	~~8-0~~	~~7-2~~	~~6-6~~	~~6-0~~	~~5-8~~	~~5-4~~
	~~3 – 2 × 10~~	~~10-11~~	~~9-6~~	~~8-6~~	~~7-9~~	~~7-2~~	~~6-8~~	~~6-4~~
	~~3 – 2 × 12~~	~~12-11~~	~~11-2~~	~~10-0~~	~~9-1~~	~~8-5~~	~~7-11~~	~~7-5~~
~~Douglas fir-larch~~[g] ~~Hem-fir~~[g] ~~Spruce-pine-fir~~[g]	~~1 – 2 × 6~~	~~3-5~~	~~2-10~~	~~2-5~~	~~2-2~~	~~2-0~~	~~1-10~~	~~1-9~~
	~~1 – 2 × 8~~	~~4-7~~	~~3-8~~	~~3-2~~	~~2-10~~	~~2-7~~	~~2-5~~	~~2-4~~
	~~1 – 2 × 10~~	~~5-8~~	~~4-9~~	~~4-1~~	~~3-8~~	~~3-4~~	~~3-1~~	~~2-11~~
	~~1 – 2 × 12~~	~~6-7~~	~~5-8~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-10~~	~~3-7~~
	~~2 – 2 × 6~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-5~~	~~3-1~~	~~2-10~~	~~2-7~~
	~~2 – 2 × 8~~	~~6-11~~	~~6-0~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-8~~	~~3-5~~
	~~2 – 2 × 10~~	~~8-5~~	~~7-4~~	~~6-6~~	~~5-10~~	~~5-2~~	~~4-9~~	~~4-5~~
	~~2 – 2 × 12~~	~~9-10~~	~~8-6~~	~~7-7~~	~~6-11~~	~~6-4~~	~~5-9~~	~~5-4~~
	~~3 – 2 × 6~~	~~6-6~~	~~5-7~~	~~5-0~~	~~4-7~~	~~4-2~~	~~3-9~~	~~3-5~~
	~~3 – 2 × 8~~	~~8-8~~	~~7-6~~	~~6-8~~	~~6-1~~	~~5-6~~	~~5-0~~	~~4-7~~
	~~3 – 2 × 10~~	~~10-7~~	~~9-2~~	~~8-2~~	~~7-6~~	~~6-11~~	~~6-4~~	~~5-10~~
	~~3 – 2 × 12~~	~~12-4~~	~~10-8~~	~~9-7~~	~~8-9~~	~~8-1~~	~~7-7~~	~~7-1~~
~~Redwood~~[h] ~~Western cedars~~[h] ~~Ponderosa pine~~[h] ~~Red pine~~[h]	~~1 – 2 × 6~~	~~3-6~~	~~2-11~~	~~2-6~~	~~2-3~~	~~2-0~~	~~1-11~~	~~1-9~~
	~~1 – 2 × 8~~	~~4-6~~	~~3-10~~	~~3-3~~	~~2-11~~	~~2-8~~	~~2-6~~	~~2-4~~
	~~1 – 2 × 10~~	~~5-6~~	~~4-9~~	~~4-2~~	~~3-9~~	~~3-5~~	~~3-2~~	~~3-0~~
	~~1 – 2 × 12~~	~~6-4~~	~~5-6~~	~~4-11~~	~~4-6~~	~~4-2~~	~~3-11~~	~~3-8~~
	~~2 – 2 × 6~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-8~~
	~~2 – 2 × 8~~	~~6-8~~	~~5-9~~	~~5-2~~	~~4-8~~	~~4-2~~	~~3-10~~	~~3-6~~
	~~2 – 2 × 10~~	~~8-2~~	~~7-1~~	~~6-4~~	~~5-9~~	~~5-4~~	~~4-10~~	~~4-6~~
	~~2 – 2 × 12~~	~~9-5~~	~~8-2~~	~~7-4~~	~~6-8~~	~~6-2~~	~~5-9~~	~~5-5~~
	~~3 – 2 × 6~~	~~6-4~~	~~5-8~~	~~5-1~~	~~4-8~~	~~4-3~~	~~3-10~~	~~3-6~~
	~~3 – 2 × 8~~	~~8-4~~	~~7-3~~	~~6-5~~	~~5-11~~	~~5-5~~	~~5-1~~	~~4-8~~
	~~3 – 2 × 10~~	~~10-2~~	~~8-10~~	~~7-11~~	~~7-2~~	~~6-8~~	~~6-3~~	~~5-11~~
	~~3 – 2 × 12~~	~~11-10~~	~~10-3~~	~~9-2~~	~~8-4~~	~~7-9~~	~~7-3~~	~~6-10~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~))

[W] ((~~TABLE R507.5(5)~~
~~JOIST SPAN FACTORS FOR CALCULATING EFFECTIVE DECK JOIST SPAN~~
~~[for use with Note j in Tables R507.5(1), R507.5(2), R507.5(3) and R507.5(4)]~~

~~C/J[a]~~	~~JOIST SPAN FACTOR~~
~~0 (no cantilever)~~	~~0.66~~
~~1/12 (0.87)~~	~~0.72~~
~~1/10 (0.10)~~	~~0.80~~
~~1/8 (0.125)~~	~~0.84~~
~~1/6 (0.167)~~	~~0.90~~
~~1/4 (0.250)~~	~~1.00~~

~~For SI: 1 foot = 304.8 mm.~~

~~a. C = actual joist cantilever length (feet); J = actual joist span length (feet).~~))

[W] TABLE R507.5
MAXIMUM DECK BEAM SPAN – 60 PSF LIVE LOAD or 70 PSF GROUND SNOW LOAD[c]

BEAM SPECIES[d]	BEAM SIZE[e]	EFFECTIVE DECK JOIST SPAN[a, i] (feet)						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH[a, b, f] (feet-inches)						
Douglas fir-larch[g], Hem-fir[g], Spruce-pine-fir[g]	1-2x6	3-5	2-10	2-5	2-2	2-0	1-10	1-9
	1-2x8	4-7	3-8	3-2	2-10	2-7	2-5	2-4
	1-2x10	5-8	4-9	4-1	3-8	3-4	3-1	2-11
	1-2x12	6-7	5-8	5-0	4-6	4-1	3-10	3-7
	2-2x6	5-2	4-6	4-0	3-5	3-1	2-10	2-7
	2-2x8	6-11	6-0	5-3	4-7	4-1	3-8	3-5
	2-2x10	8-5	7-4	6-6	5-10	5-2	4-9	4-5
	2-2x12	9-10	8-6	7-7	6-11	6-4	5-9	5-4
	3-2x6	6-6	5-7	5-0	4-7	4-2	3-9	3-5
	3-2x8	8-8	7-6	6-8	6-1	5-6	5-0	4-7
	3-2x10	10-7	9-2	8-2	7-6	6-11	6-4	5-10
	3-2x12	12-4	10-8	9-7	8-9	8-1	7-7	7-1
Redwood[h], Western Cedars[h], Ponderosa Pine[h], Red Pine[h]	1-2x6	3-6	2-11	2-6	2-3	2-0	1-11	1-9
	1-2x8	4-6	3-10	3-3	2-11	2-8	2-6	2-4
	1-2x10	5-6	4-9	4-2	3-9	3-5	3-2	3-0
	1-2x12	6-4	5-6	4-11	4-6	4-2	3-11	3-8
	2-2x6	5-3	4-7	4-1	3-6	3-2	2-11	2-8
	2-2x8	6-8	5-9	5-2	4-8	4-2	3-10	3-6
	2-2x10	8-2	7-1	6-4	5-9	5-4	4-10	4-6
	2-2x12	9-5	8-2	7-4	6-8	6-2	5-9	5-5
	3-2x6	6-4	5-8	5-1	4-8	4-3	3-10	3-6
	3-2x8	8-4	7-3	6-5	5-11	5-5	5-1	4-8
	3-2x10	10-2	8-10	7-11	7-2	6-8	6-3	5-11
	3-2x12	11-10	10-3	9-2	8-4	7-9	7-3	6-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.
b. Beams supporting a single span of joists with or without cantilever.
c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.
d. No. 2 grade, wet service factor included.
e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
g. Includes incising factor.
h. Incising factor not included.
i. Deck joist span as shown in Figure R507.5.
j. For calculation of effective joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.6.

[W] ((~~TABLE R507.6~~
~~MAXIMUM DECK JOIST SPANS~~

~~LOAD[a] (psf)~~	~~JOIST SPECIES[b]~~	~~JOIST SIZE~~	~~ALLOWABLE JOIST SPAN[b,c,e] (feet inches)~~			~~MAXIMUM CANTILEVER[d,f] (feet inches)~~							
			~~Joist spacing (inches)~~			~~Joist back span[g] (feet)~~							
			~~12~~	~~16~~	~~24~~	~~4~~	~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
~~40 live load~~	~~Southern pine~~	~~2 × 6~~	~~9-11~~	~~9-0~~	~~7-7~~	~~1-0~~	~~1-6~~	~~1-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~13-1~~	~~11-10~~	~~9-8~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-3~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~16-2~~	~~14-0~~	~~11-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-4~~	~~3-4~~	~~NP~~
		~~2 × 12~~	~~18-0~~	~~16-6~~	~~13-6~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~4-0~~	~~4-1~~
	~~Douglas fir-larch[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~2 × 6~~	~~9-6~~	~~8-4~~	~~6-10~~	~~1-0~~	~~1-6~~	~~1-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~12-6~~	~~11-1~~	~~9-1~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-3~~	~~2-0~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~15-8~~	~~13-7~~	~~11-1~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-3~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~18-0~~	~~15-9~~	~~12-10~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~3-11~~	~~3-11~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~2 × 6~~	~~8-10~~	~~8-0~~	~~6-10~~	~~1-0~~	~~1-4~~	~~1-1~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~11-8~~	~~10-7~~	~~8-8~~	~~1-0~~	~~1-6~~	~~2-0~~	~~1-11~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~14-11~~	~~13-0~~	~~10-7~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~2-9~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~17-5~~	~~15-1~~	~~12-4~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~3-8~~	~~NP~~
~~50 ground snow load~~	~~Southern pine~~	~~2 × 6~~	~~9-2~~	~~8-4~~	~~7-4~~	~~1-0~~	~~1-6~~	~~1-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~12-1~~	~~11-0~~	~~9-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-5~~	~~2-3~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~15-5~~	~~13-9~~	~~11-3~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-1~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~18-0~~	~~16-2~~	~~13-2~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~3-10~~	~~3-10~~
	~~Douglas fir-larch[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~2 × 6~~	~~8-10~~	~~8-0~~	~~6-8~~	~~1-0~~	~~1-6~~	~~1-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~11-7~~	~~10-7~~	~~8-11~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-3~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~14-10~~	~~13-3~~	~~10-10~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-0~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~17-9~~	~~15-5~~	~~12-7~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~3-8~~	~~NP~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~2 × 6~~	~~8-3~~	~~7-6~~	~~6-6~~	~~1-0~~	~~1-4~~	~~1-1~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~10-10~~	~~9-10~~	~~8-6~~	~~1-0~~	~~1-6~~	~~2-0~~	~~1-11~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~13-10~~	~~12-7~~	~~10-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-9~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~16-10~~	~~14-9~~	~~12-1~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-5~~	~~3-5~~	~~NP~~
~~60 ground snow load~~	~~Southern pine~~	~~2 × 6~~	~~8-8~~	~~7-10~~	~~6-10~~	~~1-0~~	~~1-6~~	~~1-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~11-5~~	~~10-4~~	~~8-9~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~14-7~~	~~12-9~~	~~10-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-11~~	~~2-11~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~17-3~~	~~15-0~~	~~12-3~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-6~~	~~3-7~~	~~NP~~
	~~Douglas fir-larch[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~2 × 6~~	~~8-4~~	~~7-6~~	~~6-2~~	~~1-0~~	~~1-6~~	~~1-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~10-11~~	~~9-11~~	~~8-3~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-2~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~13-11~~	~~12-4~~	~~10-0~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-10~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~16-6~~	~~14-3~~	~~11-8~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-5~~	~~3-5~~	~~NP~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~2 × 6~~	~~7-9~~	~~7-0~~	~~6-2~~	~~1-0~~	~~1-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~10-2~~	~~9-3~~	~~7-11~~	~~1-0~~	~~1-6~~	~~2-0~~	~~1-11~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~13-0~~	~~11-9~~	~~9-7~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-7~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~15-9~~	~~13-8~~	~~11-2~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-2~~	~~NP~~	~~NP~~

FLOORS

[W] ((~~TABLE R507.6—continued~~
~~MAXIMUM DECK JOIST SPANS~~

~~LOAD[a] (psf)~~	~~JOIST SPECIES[b]~~	~~JOIST SIZE~~	~~ALLOWABLE JOIST SPAN[b, c] (feet-inches)~~			~~MAXIMUM CANTILEVER[d, f] (feet-inches)~~							
			~~Joist spacing (inches)~~			~~Joist back span[g] (feet)~~							
			~~12~~	~~16~~	~~24~~	~~4~~	~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
~~70 ground snow load~~	~~Southern pine~~	~~2 × 6~~	~~8-3~~	~~7-6~~	~~6-5~~	~~1-0~~	~~1-6~~	~~1-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~10-10~~	~~9-10~~	~~8-2~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-2~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~13-9~~	~~11-11~~	~~9-9~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-9~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~16-2~~	~~14-0~~	~~11-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-5~~	~~3-5~~	~~NP~~
	~~Douglas fir-larch[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~2 × 6~~	~~7-11~~	~~7-1~~	~~5-9~~	~~1-0~~	~~1-6~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~10-5~~	~~9-5~~	~~7-8~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-1~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~13-3~~	~~11-6~~	~~9-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-8~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~15-5~~	~~13-4~~	~~10-11~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-3~~	~~NP~~	~~NP~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~2 × 6~~	~~7-4~~	~~6-8~~	~~5-10~~	~~1-0~~	~~1-4~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 8~~	~~9-8~~	~~8-10~~	~~7-4~~	~~1-0~~	~~1-6~~	~~1-11~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 10~~	~~12-4~~	~~11-0~~	~~9-0~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~2-6~~	~~NP~~	~~NP~~	~~NP~~
		~~2 × 12~~	~~14-9~~	~~12-9~~	~~10-5~~	~~1-0~~	~~1-6~~	~~2-0~~	~~2-6~~	~~3-0~~	~~3-0~~	~~NP~~	~~NP~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~NP = Not Permitted.~~

~~a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.~~

~~b. No. 2 grade, wet service factor included.~~

~~c. $L/\Delta = 360$ at main span.~~

~~d. $L/\Delta = 180$ at cantilever with a 220-pound point load applied to end.~~

~~e. Includes incising factor.~~

~~f. Incising factor not included.~~

~~g. Interpolation allowed. Extrapolation is not allowed.~~))

[W] TABLE 507.6
MAXIMUM DECK JOIST SPANS

LOAD[a] (psf)	JOIST SPECIES[b]	JOIST SIZE	ALLOWABLE JOIST SPAN[b, c] (feet-inches)			MAXIMUM CANTILEVER[f, g] (feet-inches)							
			Joist Spacing (inches)			Adjacent Joist Back Span[g] (feet)							
			12	16	24	4	6	8	10	12	14	16	18
60 live load or 70 ground snow load	Douglas fir-larch[e], Hem-fir[e], Spruce-pine-fir[e]	2 × 6	7-11	7-1	5-9	1-0	1-6	NP	NP	NP	NP	NP	NP
		2 × 8	10-5	9-5	7-8	1-0	1-6	2-0	2-1	NP	NP	NP	NP
		2 × 10	13-3	11-6	9-5	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
		2 × 12	15-5	13-4	10-11	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
	Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	2 × 6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
		2 × 8	9-8	8-10	7-4	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2 × 10	12-4	11-0	9-0	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
		2 × 12	14-9	12-9	10-5	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not Permitted

a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.

b. No. 2 grade, wet service factor included.

c. $L/\Delta = 360$ at main span.

d. $L/\Delta = 180$ at cantilever with 220-pound point load applied to end.

e. Includes incising factor.

f. Incising factor not included.

g. Interpolation permitted. Extrapolation is not permitted.

R507.6.1 Deck joist bearing. The ends of joists shall have not less than 1-1/2 inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) of bearing on concrete or masonry over its entire width. Joists bearing on top of a multiple-ply beam or ledger shall be fastened in accordance with Table R602.3(1). Joists bearing on top of a single-ply beam or ledger shall be attached by a mechanical connector. Joist framing into the side of a beam or ledger board shall be supported by *approved* joist hangers.

R507.6.2 Deck joist lateral restraint. Joist ends and bearing locations shall be provided with lateral resistance to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with not fewer than three 10d (3-inch by 0.128-inch) (76 mm by 3.3 mm) nails or three No. 10 x 3-inch-long (76 mm) wood screws.

R507.7 Decking. Maximum allowable spacing for joists supporting wood decking, excluding *stairways*, shall be in accordance with Table R507.7. Wood decking shall be attached to each supporting member with not less than two 8d threaded nails or two No. 8 wood screws. Maximum allowable spacing for joists supporting *plastic composite* decking shall be in accordance with Section R507.2. Other *approved* decking or fastener systems shall be installed in accordance with the manufacturer's installation requirements.

TABLE R507.7
MAXIMUM JOIST SPACING FOR WOOD DECKING

DECKING MATERIAL TYPE AND NOMINAL SIZE	DECKING PERPENDICULAR TO JOIST		DECKING DIAGONAL TO JOIST[a]	
	Single span[c]	Multiple span[c]	Single span[c]	Multiple span[c]
	Maximum on-center joist spacing (inches)			
1-1/4-inch-thick wood[b]	12	16	8	12
2-inch-thick wood	24	24	18	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

a. Maximum angle of 45 degrees from perpendicular for wood deck boards.

b. Other maximum span provided by an accredited lumber grading or inspection agency also allowed.

c. Individual wood deck boards supported by two joists shall be considered single span and three or more joists shall be considered multiple span.

R507.8 Vertical and lateral supports. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full *live load* specified in Table R301.5 acting on the cantilevered portion of the deck. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.

R507.9 Vertical and lateral supports at band joist. Vertical and lateral supports for decks shall comply with this section.

R507.9.1 Vertical supports. Vertical loads shall be transferred to band joists with ledgers in accordance with this section.

R507.9.1.1 Ledger details. Deck ledgers shall be a minimum 2-inch by 8-inch (51 mm by 203 mm) nominal, pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, or *approved*, naturally durable, No. 2 grade or better lumber. Deck ledgers shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.

R507.9.1.2 Band joist details. Band joists supporting a ledger shall be a minimum 2-inch-nominal (51 mm), solid-sawn, spruce-pine-fir or better lumber or a minimum 1-inch (25 mm) nominal engineered wood rim boards in accordance with Section R502.1.7. Band joists shall bear fully on the primary structure capable of supporting all required loads.

R507.9.1.3 Ledger to band joist details. Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and Figures R507.9.1.3(1) and R507.9.1.3(2).

[W] TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST

LOAD[c] (psf)	JOIST SPAN[a] (feet)	ON-CENTER SPACING OF FASTENERS[b] (inches)		
		1/2-inch diameter lag screw with 1/2-inch maximum sheathing[d, e]	1/2-inch diameter bolt with 1/2-inch maximum sheathing[e]	1/2-inch diameter bolt with 1-inch maximum sheathing[f]
((~~40 live load~~	~~6~~	~~30~~	~~36~~	~~36~~
	~~8~~	~~23~~	~~36~~	~~36~~
	~~10~~	~~18~~	~~34~~	~~29~~
	~~12~~	~~15~~	~~29~~	~~24~~
	~~14~~	~~13~~	~~24~~	~~21~~
	~~16~~	~~11~~	~~21~~	~~18~~
	~~18~~	~~10~~	~~19~~	~~16~~

[W] TABLE R507.9.1.3(1)—continued
DECK LEDGER CONNECTION TO BAND JOIST

	~~6~~	~~29~~	~~36~~	~~36~~
	~~8~~	~~22~~	~~36~~	~~35~~
	~~10~~	~~17~~	~~33~~	~~28~~
~~50 ground snow load~~	~~12~~	~~14~~	~~27~~	~~23~~
	~~14~~	~~12~~	~~23~~	~~20~~
	~~16~~	~~11~~	~~20~~	~~17~~
	~~18~~	~~9~~	~~18~~	~~15~~
	~~6~~	~~25~~	~~36~~	~~36~~
	~~8~~	~~18~~	~~35~~	~~30~~
	~~10~~	~~15~~	~~28~~	~~24~~
~~60 ground snow load~~	~~12~~	~~12~~	~~23~~	~~20~~
	~~14~~	~~10~~	~~20~~	~~17~~
	~~16~~	~~9~~	~~17~~	~~15~~
	~~18~~	~~8~~	~~15~~	~~13~~))
	6	22	36	35
	8	16	31	26
	10	13	25	21
60 live load or 70 ground snow load	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

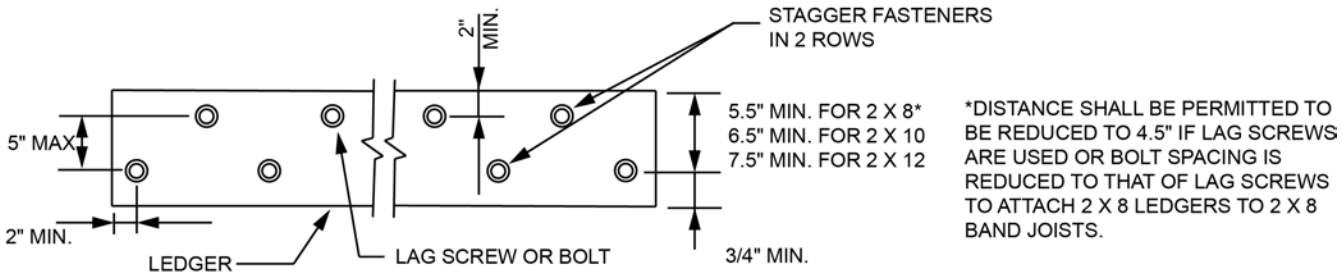
a. Interpolation permitted. Extrapolation is not permitted.
b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.
d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
e. Sheathing shall be wood structural panel or solid sawn lumber.
f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

[W] TABLE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS

MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	**BOTTOM EDGE**	**ENDS**	**ROW SPACING**
Ledger[a]	2 inches[d]	3/4 inch	2 inches[b]	1-5/8 inches[b]
Band Joist[c]	3/4 inch	2 inches	2 inches[b]	1-5/8 inches[b]

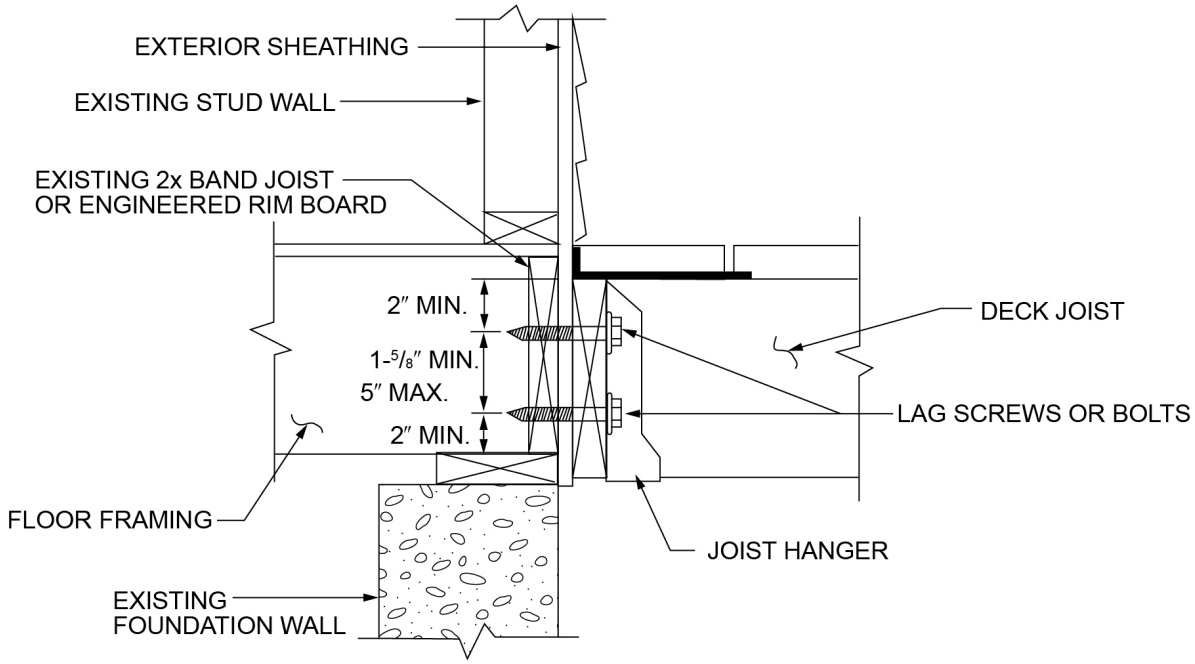
For SI: 1 inch = 25.4 mm.

a. Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).
b. Maximum 5 inches.
c. For engineered rim joists, the manufacturer's recommendations shall govern.
d. The minimum distance from bottom row of lag screws ((~~or bolts~~)) to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).
e. The 2 inches may be reduced to 3/4 inch when the band joist is directly supported by a mudsill, a header or by double top wall plates.



For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS



For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN BAND JOISTS

R507.9.1.4 Alternate ledger details. Alternate framing configurations supporting a ledger constructed to meet the load requirements of Section R301.5 shall be permitted.

[W] R507.9.2 ((~~Lateral~~)) Deck lateral load connection. Lateral loads shall be transferred to the ground or to a structure capable of transmitting them to the ground. Where the lateral load connection is provided in accordance with Figure R507.9.2(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24 inches (610 mm) of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds (6672 N). Where the lateral load connections are provided in accordance with Figure R507.9.2(2), the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds (3336 N).

Exception: Decks not more than 30 inches above grade at any point may be unattached.

CHAPTER 6

WALL CONSTRUCTION

User note:

About this chapter: *Chapter 6 contains prescriptive provisions for the design and construction of walls. The wall construction covered in Chapter 6 consists of five different types: wood framed, cold-formed steel framed, masonry, concrete and structural insulated panel (SIP). The primary concern of this chapter is the structural integrity of wall construction and transfer of all imposed loads to the supporting structure.*

SECTION R601
GENERAL

R601.1 Application. The provisions of this chapter shall control the design and construction of walls and partitions for buildings.

R601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

R601.2.1 Compressible floor-covering materials. Compressible floor-covering materials that compress more than 1/32 inch (0.8 mm) when subjected to 50 pounds (23 kg) applied over 1 inch square (645 mm) of material and are greater than 1/8 inch (3.2 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

SECTION R602
WOOD WALL FRAMING

R602.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R602.1.1 Sawn lumber. Sawn lumber shall be identified by a grade *mark* of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade *mark*, a certification of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

[W] R602.1.1.1 Used sawn lumber. Used sawn lumber identified with a grade mark, in good condition and devoid of areas of decay shall be assumed to meet the requirements of Section 602.1.1 or shall comply with the following:

1. Dimensional lumber not identified with a grade mark that has a nominal thickness of 2 inches with a nominal width of 6 inches, or less, shall be assumed to be spruce-pine-fir stud grade and shall have structural properties assigned in accordance with current adopted standards. All other dimensional lumber shall be assumed to be hem-fir No. 2 grade and shall have structural properties assigned in accordance with current adopted standards.

R602.1.2 End-jointed lumber. *Approved* end-jointed lumber identified by a grade *mark* conforming to Section R602.1 shall be permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a fire-resistance rating shall have the designation "Heat Resistant Adhesive" or "HRA" included in its grade *mark*.

R602.1.3 Structural glued-laminated timbers. Glued-laminated timbers shall be manufactured and identified as required in ANSI A190.1, ANSI 117 and ASTM D3737.

R602.1.4 Structural log members. Structural log members shall comply with the provisions of ICC 400.

R602.1.5 Structural composite lumber. Structural capacities for *structural composite lumber* shall be established and monitored in accordance with ASTM D5456.

R602.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R602.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with either ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

R602.1.8 Wood structural panels. *Wood structural panel* sheathing shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O325 or CSA O437. Panels shall be identified for grade, bond classification, and performance category by a grade *mark* or certificate of inspection issued by an *approved* agency.

R602.1.9 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade *mark* or certificate of inspection issued by an *approved* agency.

R602.1.10 Fiberboard. Fiberboard shall conform to ASTM C208. Fiberboard sheathing, where used structurally, shall be identified by an *approved* agency as conforming to ASTM C208.

R602.1.11 Structural insulated panels. *Structural insulated panels* shall be manufactured and identified in accordance with ANSI/APA PRS 610.1.

R602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception: Bearing studs not supporting floors and nonbearing studs shall be permitted to be utility grade lumber, provided that the studs are spaced in accordance with Table R602.3(5).

R602.3 Design and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2), or in accordance with AWC NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, where placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table R301.2.1(1) adjusted for height and exposure using Table R301.2.1(2) and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703.

Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof *diaphragm* or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables R602.7(1) and R602.7(2).

TABLE R602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2-1/2″ × 0.113″); or 3-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
	Blocking between rafters or truss not at the wall top plates, to rafter or truss	2-8d common (2-1/2″ × 0.131″); or 2-3″ × 0.131″ nails	Each end toe nail
		2-16d common (3-1/2″ × 0.162″); or 3-3″ × 0.131″ nails	End nail
	Flat blocking to truss and web filler	16d common (3-1/2″ × 0.162″); or 3″ × 0.131″ nails	6″ o.c. face nail
2	Ceiling joists to top plate	4-8d box (2-1/2″ × 0.113″); or 3-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions [see Section R802.5.2 and Table R802.5.2(1)]	4-10d box (3″ × 0.128″); or 3-16d common (3-1/2″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) [see Section R802.5.2 and Table R802.5.2(1)]	Table R802.5.2(1)	Face nail
5	Collar tie to rafter, face nail	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box (3-1/2″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d box (3-1/2″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box (3-1/2″ × 0.135″); or 2-16d common (3-1/2″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3-1/2″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3-1/2″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		16d common (3-1/2″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with 1/2″ spacer)	16d common (3-1/2″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3-1/2″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2-1/2″ × 0.113″); or 4-8d common (2-1/2″ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail
Wall			
12	Adjacent full-height stud to end of header	4-16d box (3-1/2″× 0.135″); or 3-16d common (3-1/2″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	End nail
13	Top plate to top plate	16d common (3-1/2″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	12″ o.c. face nail
14	Double top plate splice	8-16d common (3-1/2″ × 0.162″); or 12-16d box (3-1/2″ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)
15	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3-1/2″ × 0.162″)	16″ o.c. face nail
		16d box (3-1/2″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
Roof			
16	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3-1/2″ × 0.135″); or 2-16d common (3-1/2″ × 0.162″); or 4-3″ × 0.131″ nails	16″ o.c. face nail
17	Top or bottom plate to stud	4-8d box (2-1/2″ × 0.113″); or 3-16d box (3-1/2″ × 0.135″); or 4-8d common (2-1/2″ × 0.131″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box (3-1/2″ × 0.135″); or 2-16d common (3-1/2″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
18	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common (3-1/2″ × 0.162″); or 3-3″ × 0.131″ nails	Face nail
19	1″ brace to each stud and plate	3-8d box (2-1/2″ × 0.113″); or 2-8d common (2-1/2″ × 0.131″); or 2-(3″ × 0.131″); or 2-10d box (3″ × 0.128″)	Face nail

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
20	1″ × 6″ sheathing to each bearing	3-8d box (2-1/2″ × 0.113″); or 2-8d common (2-1/2″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1-3/4″ long	Face nail
21	1″ × 8″ and wider sheathing to each bearing	3-8d box (2-1/2″ × 0.113″); or 3-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., 1-3/4″ long	Face nail
		Wider than 1″ × 8″ 4-8d box (2-1/2″ × 0.113″); or 3-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., 1-3/4″ long	
		Floor	
22	Joist to sill, top plate or girder	4-8d box (2-1/2″ × 0.113″); or 3-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
23	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2-1/2″ × 0.113″)	4″ o.c. toe nail
		8d common (2-1/2″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails	6″ o.c. toe nail
24	1″ × 6″ subfloor or less to each joist	3-8d box (2-1/2″ × 0.113″); or 2-8d common (2-1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1-3/4″ long	Face nail
25	2″ subfloor to joist or girder	3-16d box (3-1/2″ × 0.135″); or 2-16d common (3-1/2″ × 0.162″)	Blind and face nail
26	2″ planks (plank & beam—floor & roof)	3-16d box (3-1/2″ × 0.135″); or 2-16d common (3-1/2″ × 0.162″)	At each bearing, face nail
27	Band or rim joist to joist	3-16d common (3-1/2″ × 0.162″); or 4-10 box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ × 14 ga. staples, 7/16″ crown	End nail
28	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	24″ o.c. face nail at top and bottom staggered on opposite sides
		And: 2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Face nail at ends and at each splice
29	Ledger strip supporting joists or rafters	4-16d box (3-1/2″ × 0.135″); or 3-16d common (3-1/2″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	At each joist or rafter, face nail

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION	
30	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″); or 2-8d common (2-1/2″ × 0.131″); or 3″ × 0.131″ nails	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS	
			Edges[h] (inches)	Intermediate supports[c, e] (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
31	3/8″ − 1/2″	6d common or deformed (2″ × 0.113″ × 0.266″ head); or 2-3/8″ × 0.113″ × 0.266″ head nail (subfloor, wall)[i]	6	6[f]
		8d common (2-1/2″ × 0.131″) nail (roof); or RSRS-01 (2-3/8″ × 0.113″) nail (roof)[b]	6	6[f]
32	19/32″ – 3/4″	8d common (2-2-1/2″ × 0.131″) nail (subfloor, wall)	6	12
		8d common (2-1/2″ × 0.131″) nail (roof); or RSRS-01; (2-3/8″ × 0.113″) nail (roof)[b]	6	6[f]
		Deformed 2-3/8″ × 0.113″ × 0.266″ head (wall or subfloor)	6	12
33	7/8″ – 1-1/4″	10d common (3″ × 0.148″) nail; or (2-1/2″ × 0.131 × 0.281″ head) deformed nail	6	12
Other wall sheathing[g]				
34	1/2″ structural cellulosic fiberboard sheathing	1-1/2″ × 0.120″ galvanized roofing nail, 7/16″ head diameter; or 1-1/4″ long 16 ga. staple with 7/16″ or 1″ crown	3	6
35	25/32″ structural cellulosic fiberboard sheathing	1-3/4″ × 0.120″ galvanized roofing nail, 7/16″ head diameter; or 1-1/4″ long 16 ga. staple with 7/16″ or 1″ crown	3	6
36	1/2″ gypsum sheathing[d]	1-1/2″ × 0.120″ galvanized roofing nail, 7/16″ head diameter, or 1-1/4″ long 16 ga.; staple galvanized, 1-1/2″ long; 7/16″ or 1″ crown or 1-1/4″ screws, Type W or S	7	7
37	5/8″ gypsum sheathing[d]	1-3/4″ × 0.120″ galvanized roofing nail, 7/16″ head diameter, or 1-1/4″ long 16 ga.; staple galvanized, 1-1/2″ long; 7/16″ or 1″ crown or 1-1/4″ screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
38	3/4″ and less	Deformed (2″ × 0.113″) or Deformed (2″ × 0.120″) nail; or 8d common (2-1/2″ × 0.131″) nail	6	12
39	7/8″ – 1"	8d common (2-1/2″ × 0.131″) nail; or Deformed (2-1/2″ × 0.131″); or Deformed (2-1/2″ × 0.120″) nail	6	12
40	1-1/8″ − 1-1/4″	10d common (3″ × 0.148″) nail; or Deformed (2-1/2″ × 0.131″); or Deformed (2-1/2″ × 0.120″) nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials, such as stainless steel, shall be designed by accepted engineering practice or approved under Section ((~~R104.11~~)) R104.6.

b. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with ASTM C1280 or GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION[a, b] OF FASTENER AND LENGTH (inches)	SPACING[c] OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof[g] and wall sheathing to framing and particleboard wall sheathing to framing[f]			
Up to 1/2	Staple 15 ga. 1-3/4	4	8
	0.097–0.099 Nail 2-1/4	3	6
	Staple 16 ga. 1-3/4	3	6
19/32 and 5/8	0.113 Nail 2	3	6
	Staple 15 and 16 ga. 2	4	8
	0.097–0.099 Nail 2-1/4	4	8
23/32 and 3/4	Staple 14 ga. 2	4	8
	Staple 15 ga. 1-3/4	3	6
	0.097–0.099 Nail 2-1/4	4	8
	Staple 16 ga. 2	4	8
1	Staple 14 ga. 2-1/4	4	8
	0.113 Nail 2-1/4	3	6
	Staple 15 ga. 2-1/4	4	8
	0.097–0.099 Nail 2-1/2	4	8
NOMINAL MATERIAL THICKNESS (inches)	**DESCRIPTION[a, b] OF FASTENER AND LENGTH (inches)**	**SPACING[c] OF FASTENERS**	
		Edges (inches)	**Body of panel[d] (inches)**
Floor underlayment; plywood-hardboard-particleboard[f]-fiber-cement[h]			
Fiber-cement			
1/4	1-1/4 long × 0.099″ corrosion-resistant, ring shank nails (finished flooring other than tile)	3	6
	Staple 18 ga., 7/8 long, 1/4 crown (finished flooring other than tile)	3	6
	1-1/4 long × .121 shank × .375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1-1/4 long, No. 8 × .375 head diameter, ribbed wafer-head screws (for tile finish)	8	8
Plywood			
1/4 and 5/16	1-1/4 ring or screw shank nail-minimum 12-1/2 ga. (0.099″) shank diameter	3	6
	Staple 18 ga., 7/8, 3/16 crown width	2	5
11/32, 3/8, 15/32 and 1/2	1-1/4 ring or screw shank nail-minimum 12-1/2 ga. (0.099″) shank diameter	6	8[e]
19/32, 5/8, 23/32 and 3/4	1-1/2 ring or screw shank nail-minimum 12-1/2 ga. (0.099″) shank diameter	6	8
	Staple 16 ga. 1-1/2	6	8
Hardboard[f]			
0.200	1-1/2 long × 0.080″ ring-grooved shank underlayment nail	6	6
	1-3/8 long × 0.080″ polymer cement-coated sinker nail	6	6
	Staple 18 ga., 7/8 long (plastic coated)	3	6
Particleboard			
1/4	1-1/2 long × 0.099″ ring-grooved shank underlayment nail	3	6
	Staple 18 ga., 7/8 long, 3/16 crown	3	6
3/8	2 long × 0.120″ ring-grooved shank underlayment nail	6	10
	Staple 16 ga., 1-1/8 long, 3/8 crown	3	6

TABLE R602.7.5
MINIMUM NUMBER OF FULL-HEIGHT STUDS AT EACH END OF HEADERS IN EXTERIOR WALLS[a]

MAXIMUM HEADER SPAN (feet)	ULTIMATE DESIGN WIND SPEED AND EXPOSURE CATEGORY	
	< 140 mph, Exposure B or < 130 mph, Exposure C	≤ 115 mph, Exposure B[b]
4	1	1
6	2	1
8	2	1
10	3	2
12	3	2
14	3	2
16	4	2
18	4	2

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. For header spans between those given, use the minimum number of full-height studs associated with the larger header span.

b. The tabulated minimum number of full-height studs is applicable where jack studs are provided to support the header at each end in accordance with Table R602.7(1). Where a framing anchor is used to support the header in lieu of a jack stud in accordance with Note d of Table R602.7(1), the minimum number of full-height studs at each end of a header shall be in accordance with requirements for wind speed < 140 mph, Exposure B.

R602.8 Fireblocking required. Fireblocking shall be provided in accordance with Section R302.11.

[W] R602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. ((~~Where~~)) When exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

((~~Exterior cripple~~)) Cripple walls supporting bearing walls or exterior walls or interior braced wall panels as required in Sections R403.1.2 and R602.10.9.1 with a stud height less than 14 inches (356 mm) shall be continuously sheathed on one side with wood structural panels fastened to both the top and bottom plates in accordance with Table R602.3(1), or the cripple walls shall be constructed of solid blocking.

((~~Cripple~~)) All cripple walls shall be supported on continuous foundations.

Exception: Footings supporting *cripple walls* used to support interior *braced wall panels* as required in Sections R403.1.2 and R602.10.9.1 shall be continuous for the required length of the *cripple wall* and constructed beyond the *cripple wall* for a minimum distance of 4 inches and a maximum distance of the footing thickness. The footings extension is not required at intersections with other footings.

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, *braced wall lines* shall be designated as straight lines in the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a *braced wall line* shall be the distance between its ends. The end of a *braced wall line* shall be the intersection with a perpendicular *braced wall line*, an angled *braced wall line* as permitted in Section R602.10.1.4 or an exterior wall as shown in Figure R602.10.1.1.

[W] R602.10.10 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls supporting bearing walls or *exterior walls* or interior *braced wall panels* as required in Section R403.1.2 shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

R602.10.10.1 Cripple wall bracing for Seismic Design Categories D_0 and D_1 and townhouses in Seismic Design Category C. In addition to the requirements in Section R602.10.10, cripple wall bracing shall be limited to methods WSP and CS-WSP, and the distance between adjacent edges of *braced wall panel*s for cripple walls along a *braced wall line* shall be 14 feet (4267 mm) maximum.

Where *braced wall lines* at interior walls are not supported on a continuous foundation below, the adjacent parallel cripple walls, where provided, shall be braced with Method WSP or Method CS-WSP in accordance with Section R602.10.4. The length of bracing required in accordance with Table R602.10.3(3) for the cripple walls shall be multiplied by 1.5. Where the cripple walls do not have sufficient length to provide the required bracing, the spacing of panel edge fasteners shall be reduced to 4 inches (102 mm) on center and the required bracing length adjusted by 0.7. If the required length can still not be provided, the cripple wall shall be designed in accordance with accepted engineering practice.

R602.10.10.2 Cripple wall bracing for Seismic Design Category D_2. In *Seismic Design Category* D_2, cripple walls shall be braced in accordance with Tables R602.10.3(3) and R602.10.3(4).

R602.10.10.3 Redesignation of cripple walls. Where all cripple wall segments along a *braced wall line* do not exceed 48 inches (1219 mm) in height, the cripple walls shall be permitted to be redesignated as a first-*story* wall for purposes of determining wall bracing requirements. Where any cripple wall segment in a *braced wall line* exceeds 48 inches (1219 mm) in height, the entire cripple wall shall be counted as an additional *story*. If the cripple walls are redesignated, the stories above the redesignated *story* shall be counted as the second and third stories, respectively.

R602.11 Wall anchorage. *Braced wall line* sills shall be anchored to concrete or masonry foundations in accordance with Sections R403.1.6 and R602.11.1.

R602.11.1 Wall anchorage for all buildings in Seismic Design Categories D_0, D_1 and D_2 and townhouses in Seismic Design Category C. Plate washers, not less than 0.229 inch by 3 inches by 3 inches (5.8 mm by 76 mm by 76 mm) in size, shall be provided between the foundation sill plate and the nut except where *approved* anchor straps are used. The hole in the plate washer is permitted to be diagonally slotted with a width of up to 3/16 inch (5 mm) larger than the bolt diameter and a slot length not to exceed 1-3/4 inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

R602.11.2 Stepped foundations in Seismic Design Categories D_0, D_1 and D_2. In all buildings located in *Seismic Design Categories* D_0, D_1 or D_2, where the height of a required *braced wall line* that extends from foundation to floor above varies more than 4 feet (1219 mm), the *braced wall line* shall be constructed in accordance with the following:

1. Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8 feet (2440 mm) in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate not less than 4 feet (1219 mm) along the foundation. Anchor bolts shall be located not more than 1 foot and 3 feet (305 and 914 mm) from the step in the foundation. See Figure R602.11.2.
2. Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements of Sections R602.10.10, R602.10.10.1 and R602.10.10.2 shall apply.
3. Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Sections R403.1.6 and R602.11.1 shall apply.

1. For ceiling and roof systems of wood-framed construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(9) and R608.9(10), where permitted by the tables accompanying those figures. Portions of connections of wood-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R802, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. For ceiling and roof systems of cold-formed steel construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(11) and R608.9(12), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R804, or AISI S230, if applicable.
3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction or AISI S100 for cold-formed steel-framed construction.

R608.10 Floor, roof and ceiling diaphragms. Floors and roofs in buildings with exterior walls of concrete shall be designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AWC WFCM or AISI S230, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

SECTION R609
EXTERIOR WINDOWS AND DOORS

R609.1 General. This section prescribes performance and construction requirements for exterior windows and doors installed in walls. Windows and doors shall be installed in accordance with the fenestration manufacturer's written instructions. Window and door openings shall be flashed in accordance with Section R703.4. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

R609.2 Performance. Exterior windows and doors shall be capable of resisting the design wind loads specified in Table R301.2.1(1) adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. For exterior windows and doors tested in accordance with Sections R609.3 and R609.5, required design wind pressures determined from ASCE 7 using the ultimate strength design (USD) are permitted to be multiplied by 0.6. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*.

[W] R609.3 Testing and labeling. Exterior windows and sliding doors shall be tested by an *approved* independent laboratory, and bear a *label* identifying manufacturer, performance characteristics and *approved* inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or AMD 100, or comply with Section R609.5.

Exceptions:

1. Decorative glazed openings.
2. Custom exterior windows and doors manufactured by a small business shall be exempt from all testing requirements in Section R609 provided they meet the applicable provisions of Chapter 24 of the *International Building Code*.

R609.3.1 Comparative analysis. Structural wind load design pressures for window and door units different than the size tested in accordance with Section R609.3 shall be permitted to be different than the design value of the tested unit where determined in accordance with one of the following comparative analysis methods:

1. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section R609.3 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.
2. In accordance with WDMA I.S.11.

R702.3.6 Horizontal gypsum board diaphragm ceilings. Gypsum board and gypsum panel products shall be permitted on wood joists to create a horizontal *diaphragm* in accordance with Table R702.3.6. Gypsum board and gypsum panel products shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of board and panels shall not occur on the same joist. The maximum allowable *diaphragm* proportions shall be 1-1/2:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted. Gypsum board or gypsum panel products shall not be used in *diaphragm* ceilings to resist lateral forces imposed by masonry or concrete construction. Perimeter edges shall be blocked using wood members not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board or gypsum panel product.

TABLE R702.3.6
SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES

MATERIAL	THICKNESS OF MATERIAL (min.) (inch)	SPACING OF FRAMING MEMBERS (max.) (inch)	SHEAR VALUE[a, b] (plf of ceiling)	MINIMUM FASTENER SIZE[c, d]
Gypsum board or gypsum panel product	1/2	16 o.c.	90	5d cooler or wallboard nail; 1-5/8-inch long; 0.086-inch shank; 15/64-inch head
Gypsum board or gypsum panel product	1/2	24 o.c.	70	5d cooler or wallboard nail; 1-5/8-inch long; 0.086-inch shank; 15/64-inch head

For SI: 1 inch = 25.4 mm, 1 pound per linear foot = 1.488 kg/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading caused by wind or seismic loading. Values shall be reduced 25 percent for normal loading.

b. Values shall be reduced 50 percent in *Seismic Design Categories* D_0, D_1, D_2 and E.

c. 1-1/4-inch, No. 6 Type S or W screws shall be permitted to be substituted for the listed nails.

d. Fasteners shall be spaced not more than 7 inches on center at all supports, including perimeter blocking, and not less than 3/8 inch from the edges and ends of the gypsum board.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C1178, C1278 or C1396. Use of water-resistant gypsum backing board shall be permitted on ceilings. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

R702.3.7.1 Limitations. Water-resistant gypsum backing board shall not be used where there will be direct exposure to water, or in areas subject to continuous high humidity.

R702.4 Ceramic tile.

R702.4.1 General. Ceramic tile surfaces shall be installed in accordance with ANSI A108.1, A108.4, A108.5, A108.6, A108.11, A118.1, A118.3, A136.1 and A137.1.

R702.4.2 Backer boards. Materials used as backers for wall tile in tub and shower areas and wall panels in shower areas shall be of materials listed in Table R702.4.2, and installed in accordance with the manufacturer's recommendations.

TABLE R702.4.2
BACKER BOARD MATERIALS

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Fiber-reinforced gypsum panels	ASTM C1278
Nonasbestos fiber-cement backer board	ASTM C1288 or ISO 8336, Category C
Nonasbestos fiber mat-reinforced cementitious backer units	ASTM C1325

[W] R702.5 Other finishes. Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches (406 mm) on center. Wood veneer and hard board paneling less than 1/4-inch (6 mm) nominal thickness shall not have less than a 3/8-inch (10 mm) gypsum board or gypsum panel product backer. Wood veneer paneling not less than 1/4-inch (6 mm) nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to CPA/ANSI A135.5. All structural panel components within the *conditioned space* such as plywood, particle board, wafer board and oriented strand board shall be identified as "EXPOSURE 1," "EXTERIOR" or "HUD-APPROVED."

TABLE R702.7(3)
CLASS III VAPOR RETARDERS

CLIMATE ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a, b]
Marine 4	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with *R*-value ≥ 2.5 over 2 × 4 wall.
	Continuous insulation with *R*-value ≥ 3.75 over 2 × 6 wall.
5	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall.
	Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall.
6	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall.
	Continuous insulation with *R*-value ≥ 11.25 over 2 × 6 wall.
7	Continuous insulation with *R*-value ≥ 10 over 2 × 4 wall.
	Continuous insulation with *R*-value ≥ 15 over 2 × 6 wall.
8	Continuous insulation with *R*-value ≥ 12.5 over 2 × 4 wall. Continuous insulation with *R*-value ≥ 20 over 2 × 6 wall.

a. Vented cladding shall include vinyl, polypropylene, or horizontal aluminum siding, brick veneer with a clear airspace as specified in Table R703.8.4(1), and other approved vented claddings.

b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

TABLE R702.7(4)
CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER

CLIMATE ZONE	CLASS II VAPOR RETARDERS PERMITTED FOR:[a]
3	Continuous insulation with *R*-value ≥ 2.
4, 5 and 6	Continuous insulation with *R*-value ≥ 3 over 2 × 4 wall. Continuous insulation with *R*-value ≥ 5 over 2 × 6 wall.
7	Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall. Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall.
8	Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall. Continuous insulation with *R*-value ≥ 10 over 2 × 6 wall.

a. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

R702.7.1 Spray foam plastic insulation for moisture control with Class II and III vapor retarders. For purposes of compliance with Tables R702.7(3) and R702.7(4), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior side of wood structural panels, fiberboard, *insulating sheathing* or gypsum shall be deemed to meet the continuous insulation moisture control requirement in accordance with one of the following conditions:

1. The spray foam *R*-value is equal to or greater than the specified continuous insulation *R*-value.
2. The combined *R*-value of the spray foam and continuous insulation is equal to or greater than the specified continuous insulation *R*-value.

SECTION R703
EXTERIOR COVERING

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.4.

Exception: Log walls designed and constructed in accordance with the provisions of ICC 400.

[W] R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior ((~~cladding~~))

veneer as required by Section R703.2 and a means of draining ((~~to the exterior~~)) water that ((~~penetrates the exterior cladding~~)) enters the assembly to the exterior. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section R702.7 of this code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed in accordance with Section R703.4 or R703.8.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.4, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:
   2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   2.3. Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).
   2.4. Exterior wall envelope assemblies shall be subjected to the minimum test exposure ((~~for a minimum~~)) duration of 2 hours.
3. The requirement for a means of drainage shall not be construed to mean an air space cavity under the exterior cladding for an *exterior wall* clad with panel or lapped siding made of plywood, engineered wood, hardboard, or fiber cement. A water-resistive barrier as required by Section R703.2 will be required on *exterior walls.*

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration or intersections of terminations with dissimilar materials.

Interpretation R703.1.1: According to Section R703.1 exception 3, a rain-screen or similar construction method is not required for most exterior siding and cladding, and single-wall construction is allowed. Drainage methods are required to conform to the manufacturer's installation instructions and other sections of the *International Residential Code*.

Note: The "water-resistive barrier" behind the *exterior wall* covering provides drainage of the water that may enter an *exterior wall* envelope. If water penetrates the *exterior wall* covering, the felt paper or other *approved* material will direct the water to the bottom of the wall where it will escape to the exterior.

R703.1.2 Wind resistance. Wall coverings, backing materials and their attachments shall be capable of resisting wind loads in accordance with Tables R301.2.1(1) and R301.2.1(2). Wind-pressure resistance of the siding, soffit and backing materials shall be determined by ASTM E330 or other applicable standard test methods. Where wind-pressure resistance is determined by design analysis, data from *approved* design standards and analysis conforming to generally accepted engineering practice shall be used to evaluate the siding, soffit and backing material and its fastening. All applicable failure modes including bending rupture of siding, fastener withdrawal and fastener head pull-through shall be considered in the testing or design analysis. Where the wall covering, soffit and backing material resist wind load as an assembly, use of the design capacity of the assembly shall be permitted.

R703.2 Water-resistive barrier. Not fewer than one layer of *water-resistive barrier* shall be applied over studs or sheathing of all exterior walls with flashing as indicated in Section R703.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1. Water-resistive barrier materials shall comply with one of the following:

1. No. 15 felt complying with ASTM D226, Type 1.
2. ASTM 2556, Type 1 or 2.
3. ASTM E331 in accordance with Section R703.1.1.
4. Other approved materials in accordance with the manufacturer's installation instructions.

No. 15 asphalt felt and *water-resistive barriers* complying with ASTM E2556 shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm), and where joints occur, shall be lapped not less than 6 inches (152 mm).

R703.3 Wall covering nominal thickness and attachments. The nominal thickness and attachment of exterior wall coverings shall be in accordance with Table R703.3(1), the wall covering material requirements of this section, and the wall

a. Fastener length shall be sufficient to penetrate the back side of the wood structural panel sheathing by at least 1/4 inch. The wood structural panel sheathing shall be not less than 7/16 inch in thickness.
b. Spacing of fasteners is per 12 inches of siding width. For other siding widths, multiply "Spacing of Fasteners" above by a factor of 12/s, where "s" is the siding width in inches. Fastener spacing shall never be greater than the manufacturer's minimum recommendations.

R703.3.4 Minimum fastener length and penetration. Fasteners shall have the greater of the minimum length specified in Table R703.3(1) or as required to provide a minimum penetration into framing as follows:

1. Fasteners for horizontal aluminum siding, steel siding, particleboard panel siding, wood structural panel siding in accordance with ANSI/APA-PRP 210, fiber-cement panel siding and fiber-cement lap siding installed over foam plastic sheathing shall penetrate not less than 1-1/2 inches (38 mm) into framing or shall be in accordance with the manufacturer's installation instructions.
2. Fasteners for hardboard panel and lap siding shall penetrate not less than 1-1/2 inches (38 mm) into framing.
3. Fasteners for vinyl siding and insulated vinyl siding installed over wood or wood structural panel sheathing shall penetrate not less than 1-1/4 inches (32 mm) into sheathing and framing combined. Vinyl siding and insulated vinyl siding shall be permitted to be installed with fasteners penetrating into or through wood or wood structural sheathing of minimum thickness as specified by the manufacturer's instructions or test report, with or without penetration into the framing. Where the fastener penetrates fully through the sheathing, the end of the fastener shall extend not less than 1/4 inch (6.4 mm) beyond the opposite face of the sheathing. Fasteners for vinyl siding and insulated vinyl siding installed over foam plastic sheathing shall be in accordance with Section R703.11.2. Fasteners for vinyl siding and insulated vinyl siding installed over fiberboard or gypsum sheathing shall penetrate not less than 1-1/4 inches (32 mm) into framing.
4. Fasteners for vertical or horizontal wood siding shall penetrate not less than 1-1/2 inches (38 mm) into studs, studs and wood sheathing combined, or blocking.
5. Fasteners for siding material installed over foam plastic sheathing shall have sufficient length to accommodate foam plastic sheathing thickness and to penetrate framing or sheathing and framing combined, as specified in Items 1 through 4.

[W] R703.4 Flashing. *Approved* corrosion-resistant flashing shall be applied *shingle-fashion* in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall be installed in accordance with Section R703.4.1.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood *trim*.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope; joints at the perimeter of opening penetration; or intersections of terminations with dissimilar materials.

R703.4.1 Flashing installation at exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to a *water-resistive barrier* complying with Section 703.2 for subsequent drainage. Air sealing shall be installed around all window and door openings on the interior side of the rough opening gap. Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:

1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, *pan flashing* shall be installed at the sill of exterior window and door openings. *Pan flashing* shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using *pan flashing* shall incorporate flashing or protection at the head and sides.
2. In accordance with the flashing design or method of a *registered design professional.*
3. In accordance with other *approved* methods.

R703.8.5 Flashing. Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels where masonry veneers are designed in accordance with Section R703.8. See Section R703.4 for additional requirements.

R703.8.6 Weepholes. Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weepholes shall be not less than 3/16 inch (5 mm) in diameter. Weepholes shall be located immediately above the flashing.

R703.9 Exterior insulation and finish system (EIFS)/EIFS with drainage. Exterior insulation and finish systems (EIFS) shall comply with this chapter and Section R703.9.1. EIFS with drainage shall comply with this chapter and Section R703.9.2.

R703.9.1 Exterior insulation and finish systems (EIFS). EIFS shall comply with the following:

1. ASTM E2568.
2. EIFS shall be limited to applications over substrates of concrete or masonry wall assemblies.
3. Flashing of EIFS shall be provided in accordance with the requirements of Section R703.4.
4. EIFS shall be installed in accordance with the manufacturer's instructions.
5. EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level.
6. Decorative *trim* shall not be face-nailed through the EIFS.

R703.9.2 Exterior insulation and finish system (EIFS) with drainage. EIFS with drainage shall comply with the following:

1. ASTM E2568.
2. EIFS with drainage shall be required over all wall assemblies with the exception of substrates of concrete or masonry wall assemblies.
3. EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance with ASTM E2273.
4. The *water-resistive barrier* shall comply with Section R703.2 or ASTM E2570.
5. The *water-resistive barrier* shall be applied between the EIFS and the wall sheathing.
6. Flashing of EIFS with drainage shall be provided in accordance with the requirements of Section R703.4.
7. EIFS with drainage shall be installed in accordance with the manufacturer's instructions.
8. EIFS with drainage shall terminate not less than 6 inches (152 mm) above the finished ground level.
9. Decorative *trim* shall not be face-nailed through the EIFS with drainage.

R703.10 Fiber cement siding.

R703.10.1 Panel siding. Fiber-cement panels shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be protected with caulking, or with battens or flashing, or be vertical or horizontal shiplap, or otherwise designed to comply with Section R703.1. Panel siding shall be installed with fasteners in accordance with Table R703.3(1) or the approved manufacturer's instructions.

[W] R703.10.2 Lap siding. Fiber-cement lap siding having a maximum width of 12 inches (305 mm) shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Lap siding shall be lapped a minimum of 1-1/4 inches (32 mm) and lap siding ((~~not having tongue-and-groove end joints shall have the ends protected with caulking, covered with an H-section joint cover, located over a strip of flashing,~~)) shall be installed in accordance with the manufacturer's installation instructions or shall be designed to comply with Section R703.1. Lap siding courses shall be installed with the fastener heads exposed or concealed, in accordance with Table R703.3(1) or approved manufacturer's instructions.

R703.11 Vinyl siding. Vinyl siding shall be certified and *labeled* as conforming to the requirements of ASTM D3679 by an *approved* quality control agency.

R703.11.1 Installation. Vinyl siding, soffit and accessories shall be installed in accordance with the manufacturer's instructions.

R703.11.1.1 Fasteners. Unless specified otherwise by the manufacturer's instructions, fasteners for vinyl siding shall be 0.120-inch (3 mm) shank diameter nail with a 0.313-inch (8 mm) head or 16-gage staple with a 3/8-inch (9.5 mm) to 1/2-inch (12.7 mm) crown.

R703.11.1.2 Penetration depth. Unless specified otherwise by the manufacturer's instructions, fasteners shall penetrate into building framing. The total penetration into sheathing, furring framing or other *nailable substrate* shall be a minimum 1-1/4 inches (32 mm). Where specified by the manufacturer's instructions and supported by a test report, fasteners

SECTION R805
CEILING FINISHES

R805.1 Ceiling installation. Ceilings shall be installed in accordance with the requirements for interior wall finishes as provided in Sections R702.1 through R702.6.

SECTION R806
ROOF VENTILATION

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross *ventilation* for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air and shall be protected to prevent the entry of birds, rodents, snakes and other similar creatures.

R806.2 Minimum vent area. The minimum net free ventilating area shall be 1/150 of the area of the vented space.

Exception: The minimum net free ventilation area shall be 1/300 of the vented space provided both of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. Not less than 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically. The balance of the required *ventilation* provided shall be located in the bottom one-third of the attic space. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

R806.3 Vent and insulation clearance. Where eave or cornice vents are installed, blocking, bridging and insulation shall not block the free flow of air. Not less than a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

R806.4 Installation and weather protection. Ventilators shall be installed in accordance with manufacturer's instructions. Installation of ventilators in roof systems shall be in accordance with the requirements of Section R903. Installation of ventilators in wall systems shall be in accordance with the requirements of Section R703.1.

[W] R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented *attic*s and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members/rafters, shall be permitted where all the following conditions are met:

1. The unvented *attic* space is completely within the *building thermal envelope*.
2. Interior Class I vapor retarders are not installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, a minimum 1/4-inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. ((~~In Climate Zones 5, 6, 7 and 8, any~~)) Any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall comply with Item 5.3 and either Item 5.1 or 5.2:
    - 5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
        - 5.1.1. Where only *air-impermeable insulation* is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.
        - 5.1.2. Where *air-permeable insulation* is installed directly below the structural sheathing, minimum R-10 rigid board or sheet insulation shall be installed directly above the structural roof sheathing ((~~in accordance with the *R*-values in Table R806.5~~)) for condensation control.
        - 5.1.3. Where both *air-impermeable* and *air-permeable insulation* are provided, ((~~the~~)) minimum R-10 *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 ((~~and shall be in accordance with the *R*-values in~~

~~Table R806.5~~)) for condensation control. The *air-permeable insulation* shall be installed directly under the *air-impermeable insulation*.

5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented *attics* shall meet the following requirements:

5.2.1. An approved *vapor diffusion port* shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.

5.2.2. The port area shall be greater than or equal to 1:600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.

5.2.3. The vapor-permeable membrane in the *vapor diffusion port* shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.

5.2.4. The *vapor diffusion port* shall serve as an air barrier between the *attic* and the exterior of the building.

5.2.5. The *vapor diffusion port* shall protect the *attic* against the entrance of rain and snow.

5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (51 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7. The roof slope shall be greater than or equal to 3:12 (vertical/horizontal).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top of the attic floor, or on top of the ceiling.

5.2.9. *Air-impermeable insulation*, where used in conjunction with air-permeable insulation, shall be directly above or below the structural roof sheathing and is not required to meet the *R*-value in Table R806.5. Where directly below the structural roof sheathing, there shall be no space between the *air-impermeable insulation* and air-permeable insulation.

5.2.10. Where air-permeable insulation is used and is installed directly below the roof structural sheathing, air shall be supplied at a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m^2) of ceiling. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating.

Exceptions:

1. Where both air-impermeable and air-permeable insulation are used, and the *R*-value in Table 806.5 is met, air supply to the attic is not required.
2. Where only air-permeable insulation is used and is installed on top of the attic floor, or on top of the ceiling, air supply to the attic is not required.

5.3. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

R903.2.1 Locations. Flashings shall be installed at wall and roof intersections, wherever there is a change in roof slope or direction and around roof openings. A flashing shall be installed to divert the water away from where the eave of a sloped roof intersects a vertical sidewall. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.5 mm) (No. 26 galvanized sheet).

R903.2.2 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: *Unit skylights* installed in accordance with Section R308.6 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

R903.4 Roof drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof.

[W] R903.4.1 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary emergency overflow ((~~roof~~)) drains or *scuppers* shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. Overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches (51 mm) above the low point of the roof, or overflow *scuppers* having three times the size of the roof drains and having a minimum opening height of 4 inches (102 mm) shall be installed in the adjacent parapet walls with the inlet flow located 2 inches (51 mm) above the low point of the roof served. The installation and sizing of overflow drains, leaders and conductors shall comply with Sections ((~~1106 and 1108~~)) 1101 and 1103 of the ((~~*International*~~)) *Uniform Plumbing Code*, as applicable.

Overflow drains shall discharge to an *approved* location. ((~~and shall not be connected to roof drain lines.~~))

SECTION R904
MATERIALS

R904.1 Scope. The requirements set forth in this section shall apply to the application of roof covering materials specified herein. *Roof assemblies* shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of *roof assemblies* shall comply with the applicable provisions of Section R905.

R904.2 Compatibility of materials. *Roof assemblies* shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

R904.3 Material specifications and physical characteristics. Roof covering materials shall conform to the applicable standards listed in this chapter.

R904.4 Product identification. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and *approved* testing agency *labels* required. Bulk shipments of materials shall be accompanied by the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION R905
REQUIREMENTS FOR ROOF COVERINGS

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. Unless otherwise specified in this section, roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, *metal roof shingles*, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, *metal roof panels* and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a *label* indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance with ASTM D1970 and installed in accordance with both the underlayment manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.

R1001.7 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of *noncombustible material*. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the lintel.

[W] R1001.7.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or the chimney venting the fireplace, and shall be operable from the room containing the fireplace. Fireplaces shall be provided with each of the following:

1. Tightly fitting flue dampers, operated by a *readily accessible* manual or *approved* automatic control.

   Exception: Fireplaces with gas logs shall be installed in accordance with the *International Mechanical Code* Section 901, except that the standards for liquefied petroleum gas installations shall be NFPA 58 (*Liquefied Petroleum Gas Code*) and NFPA 54 (*National Fuel Gas Code*).

2. An outside source for *combustion air* ducted into the firebox. The duct shall be at least 6 square inches, and shall be provided with an operable outside air duct damper.
3. Site built fireplaces shall have tight-fitting glass or metal doors, or a flue draft induction fan or as *approved* for minimizing backdrafting. Factory built fireplaces shall use doors *listed* for the installed *appliance.*

R1001.8 Smoke chamber. Smoke chamber walls shall be constructed of *solid masonry* units, *hollow masonry units* grouted solid, stone or concrete. The total minimum thickness of front, back and side walls shall be 8 inches (203 mm) of *solid masonry*. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than 5/8 inch (16 mm) thick, is provided, the total minimum thickness of front, back and side walls shall be 6 inches (152 mm) of *solid masonry*, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

R1001.8.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.79 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

R1001.9 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by *noncombustible materials*, and reinforced to carry their own weight and all imposed loads. *Combustible material* shall not remain against the underside of hearths and hearth extensions after construction.

R1001.9.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

R1001.9.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than 3/8-inch-thick (10 mm) brick, concrete, stone, tile or other *approved noncombustible material* is permitted.

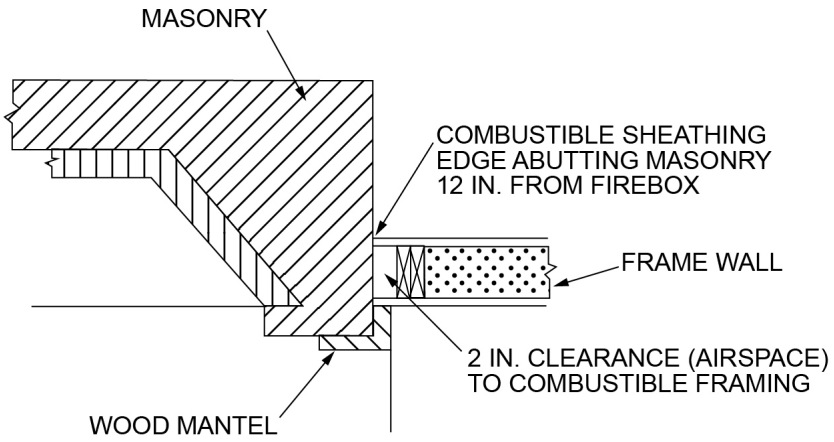
R1001.10 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of and not less than 8 inches (203 mm) beyond each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.6 m^2) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of and not less than 12 inches (305 mm) beyond each side of the fireplace opening.

R1001.11 Fireplace clearance. Wood beams, joists, studs and other *combustible material* shall have a clearance of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section R1001.12.

Exceptions:

1. Masonry fireplaces *listed* and *labeled* for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have *combustible material* in contact with their exterior surfaces.
2. Where masonry fireplaces are part of masonry or concrete walls, *combustible materials* shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible *trim* and the edges of sheathing materials such as wood siding, flooring and gypsum board shall be permitted to abut the masonry fireplace sidewalls and hearth extension in accordance with Figure R1001.11, provided such combustible *trim* or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or *trim* is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening providing such *combustible materials* are not placed within 6 inches (152 mm) of a fireplace

opening. *Combustible material* within 12 inches (306 mm) of the fireplace opening shall not project more than 1/8 inch (3 mm) for each 1-inch (25 mm) distance from such an opening.



For SI: 1 inch = 25.4 mm.

FIGURE R1001.11
CLEARANCE FROM COMBUSTIBLES

R1001.12 Fireplace fireblocking. Fireplace fireblocking shall comply with the provisions of Section R602.8.

R1001.13 Fireplace accessories. *Listed* and *labeled* fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's instructions. Fireplace accessories shall comply with UL 907.

SECTION R1002
MASONRY HEATERS

R1002.1 Definition. A *masonry heater* is a heating *appliance* constructed of concrete or *solid masonry*, hereinafter referred to as masonry, that is designed to absorb and store heat from a solid-fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in a horizontal or downward direction before entering the chimney and that delivers heat by radiation from the masonry surface of the heater.

[W] R1002.2 Installation. *Masonry heaters* shall be installed in accordance with this section and shall be a masonry heater type *approved* by the Department of Ecology. Masonry heaters shall comply with one of the following:

1. *Masonry heaters* shall comply with the requirements of ASTM E1602; ((-)) or
2. *Masonry heaters* shall be *listed* and *labeled* in accordance with UL 1482 or CEN 15250 and installed in accordance with the manufacturer's instructions.

[W] R1002.2.1 Combustion air and doors. Masonry heaters shall be provided with both of the following:

1. Primary *combustion air* ducted from the outside of the structure to the *appliance*.
2. Tight fitting ceramic glass or metal doors. Flue dampers, when provided, shall have an external control and when in the closed position shall have a net free area of not less than 5% of the flue cross sectional area.

R1002.3 Footings and foundation. The firebox floor of a *masonry heater* shall be a minimum thickness of 4 inches (102 mm) of *noncombustible material* and be supported on a noncombustible footing and foundation in accordance with Section R1003.2.

R1002.4 Seismic reinforcing. In *Seismic Design Categories* D_0, D_1 and D_2, *masonry heaters* shall be anchored to the masonry foundation in accordance with Section R1003.3. Seismic reinforcing shall not be required within the body of a *masonry heater* whose height is equal to or less than 3.5 times its body width and where the *masonry chimney* serving the heater is not supported by the body of the heater. Where the *masonry chimney* shares a common wall with the facing of the *masonry heater*, the chimney portion of the structure shall be reinforced in accordance with Section R1003.

R1002.5 Masonry heater clearance. *Combustible materials* shall not be placed within 36 inches (914 mm) of the outside surface of a *masonry heater* in accordance with NFPA 211 Section 8-7 (clearances for solid-fuel-burning *appliances*), and the required space between the heater and *combustible material* shall be fully vented to permit the free flow of air around all heater surfaces.

TABLE R1003.20
CRICKET DIMENSIONS

ROOF SLOPE	H
12:12	1/2 of W
8:12	1/3 of W
6:12	1/4 of W
4:12	1/6 of W
3:12	1/8 of W

SECTION R1004
FACTORY-BUILT FIREPLACES

R1004.1 General. Factory-built fireplaces shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the *listing*. Factory-built fireplaces shall be tested in accordance with UL 127.

[W] R1004.1.1 Emission standards for factory-built fireplaces. No new or used factory-built fireplace shall be installed in Washington State unless it is certified and *labeled* in accordance with procedures and criteria specified in ASTM E2558 Standard Test Method for determining particulate matter emission from fires in low mass wood burning fireplaces.

To certify an entire fireplace model line, the internal assembly shall be tested to determine its particulate matter emission performance. Retesting and recertifying is required if the design and construction specifications of the fireplace model line internal assembly change. Testing for certification shall be performed by a Washington state Department of Ecology (DOE) *approved* and U.S. Environmental Protection Agency (EPA) accredited laboratory.

[W] R1004.1.2 Emission standards for certified masonry and concrete fireplaces. Masonry and concrete fireplace model lines certified to *Washington State Building Code* Standard 31-2 prior to July 1, 2013, may retain certification provided the design and construction specifications of the fireplace model line internal assembly do not change.

R1004.2 Hearth extensions. Hearth extensions of *approved* factory-built fireplaces shall be installed in accordance with the *listing* of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area. *Listed* and *labeled* hearth extensions shall comply with UL 1618.

R1004.3 Decorative shrouds. Decorative shrouds shall not be installed at the termination of chimneys for factory-built fireplaces except where the shrouds are *listed* and *labeled* for use with the specific factory-built fireplace system and installed in accordance with the manufacturer's instructions.

R1004.4 Unvented gas log heaters. An unvented gas log heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, *listed* and *labeled* for such use in accordance with UL 127.

R1004.5 Gasketed fireplace doors. A gasketed fireplace door shall not be installed on a factory-built fireplace except where the fireplace system has been specifically tested, *listed* and *labeled* for such use in accordance with UL 127.

SECTION R1005
FACTORY-BUILT CHIMNEYS

R1005.1 Listing. *Factory-built chimneys* shall be *listed* and *labeled* and shall be installed and terminated in accordance with the *manufacturer's installation instructions*.

R1005.2 Decorative shrouds. Decorative shrouds shall not be installed at the termination of *factory-built chimneys* except where the shrouds are *listed* and *labeled* for use with the specific *factory-built chimney* system and installed in accordance with the *manufacturer's installation instructions*.

R1005.3 Solid-fuel appliances. *Factory-built chimneys* installed in *dwelling units* with solid-fuel-burning *appliances* shall comply with the Type HT requirements of UL 103 and shall be marked "Type HT" and "Residential Type and Building Heating Appliance Chimney."

Exception: *Chimneys* for use with open combustion chamber fireplaces shall comply with the requirements of UL 103 and shall be marked "Residential Type and Building Heating Appliance Chimney."

Chimneys for use with open combustion chamber *appliances* installed in buildings other than *dwelling units* shall comply with the requirements of UL 103 and shall be marked "Building Heating Appliance Chimney" or "Residential Type and Building Heating Appliance Chimney."

R1005.4 Factory-built fireplaces. *Chimneys* for use with factory-built fireplaces shall comply with the requirements of UL 127.

R1005.5 Support. Where *factory-built chimneys* are supported by structural members, such as joists and rafters, those members shall be designed to support the additional load.

R1005.6 Medium-heat appliances. *Factory-built chimneys* for medium-heat *appliances* producing flue gases having a temperature above 1,000°F (538°C), measured at the entrance to the *chimney*, shall comply with UL 959.

R1005.7 Factory-built chimney offsets. Where a *factory-built chimney* assembly incorporates offsets, no part of the *chimney* shall be at an angle of more than 30 degrees (0.52 rad) from vertical at any point in the assembly and the chimney assembly shall not include more than four elbows.

R1005.8 Insulation shield. Where *factory-built chimneys* pass through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 0.0187 inch (0.4712 mm) (No. 26 gage) shall be installed to provide clearance between the *chimney* and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the chimney *manufacturer's installation instructions*. Where *chimneys* pass through attic space, the shield shall terminate not less than 2 inches (51 mm) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a *listed* chimney system shall be installed in accordance with the manufacturer's installation instructions.

SECTION R1006
EXTERIOR AIR SUPPLY

R1006.1 Exterior air. Factory-built or masonry fireplaces covered in this chapter shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

[W] ((~~R1006.1.1 Factory-built fireplaces.~~ ~~Exterior *combustion air* ducts for factory-built fireplaces shall be a *listed* component of the fireplace and shall be installed in accordance with the fireplace manufacturer's instructions.~~))

[W] ((~~R1006.1.2 Masonry fireplaces.~~ ~~*Listed combustion air* ducts for masonry fireplaces shall be installed in accordance with the terms of their *listing* and the manufacturer's instructions.~~))

[W] ((~~R1006.2 Exterior air intake.~~ ~~The exterior air intake shall be capable of supplying all *combustion air* from the exterior of the *dwelling* or from spaces within the *dwelling* ventilated with outdoor air such as nonmechanically ventilated crawl or attic spaces. The exterior air intake shall not be located within the garage or *basement* of the dwelling. The exterior air intake, for other than *listed* factory-built fireplaces, shall not be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of 1/4-inch (6.4 mm) mesh.~~))

[W] R1006.2 Solid fuel burning appliances and fireplaces. Solid-fuel-burning *appliances* and fireplaces shall be provided with tight-fitting metal or ceramic glass doors, and:

1. A source from outside the structure of primary *combustion air*, connected to the *appliance* as per manufacturer's specification. The air inlet shall originate at a point below the fire box. The duct shall be 4 inches or greater in diameter, not exceed 20 feet in length, and be installed as per manufacturer's instructions; or
2. The *appliance* and manufacturer's recommended *combustion air* supply, as an installed unit, shall be certified by an independent testing laboratory to have passed Test No. 11-Negative Pressure Test, Section 12.3, of ULC S627-M1984 "Space Heaters for Use with Solid Fuels," modified as follows:
    2.1. Negative pressure of 8 Pascal shall be initially established with the chamber sealed and the air supply, if not directly connected to the *appliance*, closed off.
    2.2. The air supply if not directly connected to the *appliance*, shall then be opened.
    2.3. The maximum allowable air exchange rate from chamber leakage and intentional air supply for the unit (*appliance* with *combustion air* supply) in the test chamber is 3.5 air changes per hour, or 28 cfm (cubic feet of air per minute), whichever is less.

        Exception: *Combustion air* may be supplied to the room in which the solid-fuel-burning *appliance* is located in lieu of direct ducting, provided that one of the following conditions is met:

        1. The solid-fuel-burning *appliance* is part of a central heating plant and installed in an un*conditioned space* in conformance with the *International Mechanical Code*; or
        2. The solid-fuel-burning *appliance* is installed in existing construction directly on a concrete floor or surrounded by masonry materials as in a fireplace. The *combustion air* terminus shall be located as close to the solid fuel burning *appliance* as possible and shall be provided with a barometric damper or equivalent. The *combustion air* source shall be specified by the manufacturer or no less than 4 inches in diameter or the equivalent in area or as *approved*.

R1006.3 Clearance. Unlisted *combustion air* ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

[W] R1006.4 ((~~Passageway~~)) Reserved. ((~~The *combustion air* passageway shall be not less than 6 square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2), except that *combustion air* systems for *listed* fireplaces shall be constructed in accordance with the fireplace manufacturer's instructions.~~))

R1006.5 Outlet. The exterior air outlet shall be located in the back or side of the firebox chamber or shall be located outside of the firebox, at the level of the hearth and not greater than 24 inches (610 mm) from the firebox opening. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

R1006.6 Solid fuel burning appliances and fireplaces. Solid fuel burning appliances and fireplaces shall be provided with tight fitting metal or ceramic glass doors, and:

1. A source from outside the structure of primary combustion air, connected to the appliance as per manufacturer's specification. The air inlet shall originate at a point below the fire box. The duct shall be 4 inches or greater in diameter, not exceed 20 feet in length, and be installed as per manufacturer's instructions; or
2. The appliance and manufacturer's recommended combustion air supply, as an installed unit, shall be certified by an independent testing laboratory to have passed Test No. 11-Negative Pressure Test, Section 12.3, of ULC S627-M1984 "Space Heaters for Use with Solid Fuels," modified as follows:
   Negative pressure of 8 Pascal shall be initially established with the chamber sealed and the air supply, if not directly connected to the appliance, closed off.
   The air supply if not directly connected to the appliance, shall then be opened.
   The maximum allowable air exchange rate from chamber leakage and intentional air supply for the unit (appliance with combustion air supply) in the test chamber is 3.5 air changes per hour, or 28 cfm (cubic feet of air per minute), whichever is less.

Exception: Combustion air may be supplied to the room in which the solid fuel burning appliance is located in lieu of direct ducting, provided that one of the following conditions is met:

1. The solid fuel burning appliance is part of a central heating plant and installed in an unconditioned space in conformance with the International Mechanical Code; or
2. The solid fuel burning appliance is installed in existing construction directly on a concrete floor or surrounded by masonry materials as in a fireplace. The combustion air terminus shall be located as close to the solid fuel burning appliance as possible and shall be provided with a barometric damper or equivalent. The combustion air source shall be specified by the manufacturer or no less than 4 inches in diameter or the equivalent in area or as approved.

Part IV—Energy Conservation

CHAPTER 11 [RE]

ENERGY EFFICIENCY

Note: Chapter 11 is not adopted by The City of Seattle. See the *Seattle Energy Conservation Code.*

Part V—Mechanical

CHAPTER 12
MECHANICAL ADMINISTRATION

User notes:

About this chapter: *Chapter 12 supplements Chapter 1 and establishes the scope of coverage for Chapters 13 through 24. The applicability of code provisions to existing mechanical systems and appliances is established herein.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M1201
GENERAL

[W] M1201.1 Scope. The provisions of Chapters 12 through 24 shall regulate the design, installation, maintenance, *alteration* and inspection of mechanical systems that are permanently installed and used to control environmental conditions within buildings. These chapters shall also regulate those mechanical systems, system components, *equipment* and *appliances* specifically addressed in this code.

Exception: The standards for liquefied petroleum gas installations shall be NFPA 58 (*Liquefied Petroleum Gas Code*) and ANSI Z223.1/NFPA 54 (*National Fuel Gas Code*).

M1201.2 Application. In addition to the general administration requirements of Chapter 1, the administrative provisions of this chapter shall apply to the mechanical requirements of Chapters 13 through 24.

[W] M1201.3 Construction documents. The plans and specifications shall show in sufficient detail pertinent data and features of the materials, *equipment* and systems as herein governed including, but not limited to: design criteria, size and type of apparatus and *equipment*, systems and *equipment* controls, provisions for *combustion air* to fuel-burning *appliances*, and other pertinent data to indicate conformance with the requirements of this code.

[W] M1201.4 Testing. At the discretion of the *building official*, flow testing may be required to verify that the mechanical system satisfies the requirements of this code. Specific testing required by other sections of this code shall be performed. Flow testing may be performed using flow hoods measuring at the intake or exhaust points of the system, in-line pitot tube, or pitot-traverse type measurement systems in the duct, short-term tracer gas measurements, or other means *approved* by the *building official*.

SECTION M1202
EXISTING MECHANICAL SYSTEMS

M1202.1 Additions, alterations or repairs. *Additions*, *alterations*, renovations or repairs to a mechanical system shall conform to the requirements for a new mechanical system without requiring the existing mechanical system to comply with all of the requirements of this code. *Additions*, *alterations* or repairs shall not cause an existing mechanical system to become unsafe, hazardous or overloaded. Minor *additions*, *alterations* or repairs to existing mechanical systems shall meet the provisions for new construction, unless such work is done in the same manner and arrangement as was in the existing system, is not hazardous, and is *approved*.

M1202.2 Existing installations. Except as otherwise provided for in this code, a provision in this code shall not require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing mechanical system lawfully in existence at the time of the adoption of this code.

M1202.3 Maintenance. Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the code edition under which such devices and safeguards were installed. The *owner* or the owner's designated agent shall be responsible for maintenance of the mechanical systems. To determine compliance with this provision, the *building official* shall have the authority to require a mechanical system to be reinspected.

CHAPTER 13

GENERAL MECHANICAL SYSTEM REQUIREMENTS

User notes:

About this chapter: *Chapter 13 contains general requirements that apply broadly and that would not be at home in other chapters that address specific subject matter. Coverage includes: Testing and certification of materials, installation requirements, listing and labeling, access to appliances, clearances to combustibles, and protection of mechanical systems and the building structure.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M1301
GENERAL

M1301.1 Scope. The provisions of this chapter shall govern the installation of mechanical systems not specifically covered in other chapters applicable to mechanical systems. Installations of mechanical *appliances*, *equipment* and systems not addressed by this code shall comply with the applicable provisions of the *International Fuel Gas Code* and the *International Mechanical Code*.

M1301.1.1 Flood-resistant installation. In flood hazard areas as established by Table R301.2, mechanical *appliances*, *equipment* and systems shall be located or installed in accordance with Section R322.1.6.

M1301.2 Identification. Each length of pipe and tubing and each pipe fitting utilized in a mechanical system shall bear the identification of the manufacturer.

M1301.3 Installation of materials. Materials shall be installed in strict accordance with the standards under which the materials are accepted and *approved*. In the absence of such installation procedures, the manufacturer's instructions shall be followed. Where the requirements of referenced standards or manufacturer's instructions do not conform to minimum provisions of this code, the provisions of this code shall apply.

M1301.4 Plastic pipe, fittings and components. Plastic pipe, fittings and components shall be third-party certified as conforming to NSF 14.

M1301.5 Third-party testing and certification. Piping, tubing and fittings shall comply with the applicable referenced standards, specifications and performance criteria of this code and shall be identified in accordance with Section M1301.2. Piping, tubing and fittings shall either be tested by an *approved* third-party testing agency or certified by an *approved* third-party certification agency.

SECTION M1302
APPROVAL

M1302.1 Listed and labeled. *Appliances* regulated by this code shall be *listed* and *labeled* for the application in which they are installed and used, unless otherwise *approved* in accordance with Section ((~~R104.11~~)) R104.6.

SECTION M1303
LABELING OF APPLIANCES

M1303.1 Label information. A permanent factory-applied nameplate(s) shall be affixed to *appliances* on which shall appear, in legible lettering, the manufacturer's name or trademark, the model number, a serial number and the seal or *mark* of the testing agency. A *label* also shall include the following:

1. Electrical *appliances*. Electrical rating in volts, amperes and motor phase; identification of individual electrical components in volts, amperes or watts and motor phase; and in Btu/h (W) output and required clearances.
2. Absorption units. Hourly rating in Btu/h (W), minimum hourly rating for units having step or automatic modulating controls, type of fuel, type of refrigerant, cooling capacity in Btu/h (W) and required clearances.
3. Fuel-burning units. Hourly rating in Btu/h (W), type of fuel approved for use with the *appliance* and required clearances.

[W] M1307.2 Anchorage of appliances. *Appliances* designed to be fixed in position shall be fastened or anchored in an *approved* manner. ((~~In Seismic Design Categories D_0, D_1 and D_2, and in townhouses in Seismic Design Category C, water heaters and thermal~~)) Thermal storage units shall be anchored or strapped to resist horizontal displacement caused by earthquake motion in accordance with one of the following:

1. Anchorage and strapping shall be designed to resist a horizontal force equal to one-third of the operating weight of the water ((~~heater~~)) storage tank, acting in any horizontal direction. ((~~Strapping shall be at points within the upper one-third and lower one-third of the *appliance's* vertical dimensions. At the lower point, the strapping shall maintain a minimum distance of 4 inches (102 mm) above the controls.~~))
2. The anchorage strapping shall be in accordance with the appliance manufacturer's recommendations.

Seismic anchorage and strapping of water heaters shall be in accordance with Section 507.2 of the *Uniform Plumbing Code*.

M1307.3 Elevation of ignition source. *Appliances* having an *ignition source* shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in garages. For the purpose of this section, rooms or spaces that are not part of the *living space* of a *dwelling unit* and that communicate with a private garage through openings shall be considered to be part of the garage.

Exception: Elevation of the *ignition source* is not required for *appliances* that are *listed* as flammable-vapor-ignition resistant.

M1307.3.1 Protection from impact. *Appliances* shall not be installed in a location subject to vehicle damage except where protected by *approved* barriers.

M1307.4 Hydrogen-generating and refueling operations. *Ventilation* shall be required in accordance with Section M1307.4.1, M1307.4.2 or M1307.4.3 in private garages that contain hydrogen-generating *appliances* or refueling systems. For the purpose of this section, rooms or spaces that are not part of the *living space* of a *dwelling unit* and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

M1307.4.1 Natural ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be limited to a maximum floor area of 850 square feet (79 m^2) and shall communicate with the outdoors in accordance with Sections M1307.4.1.1 and M1307.4.1.2. The maximum rated output capacity of hydrogen-generating *appliances* shall not exceed 4 standard cubic feet per minute (1.9 L/s) of hydrogen for each 250 square feet (23 m^2) of floor area in such spaces. The minimum cross-sectional dimension of air openings shall be 3 inches (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In those locations, *equipment* and *appliances* having an *ignition source* shall be located so that the source of ignition is not within 12 inches (305 mm) of the ceiling.

M1307.4.1.1 Two openings. Two permanent openings shall be constructed within the garage. The upper opening shall be located entirely within 12 inches (305 mm) of the ceiling of the garage. The lower opening shall be located entirely within 12 inches (305 mm) of the floor of the garage. Both openings shall be constructed in the same exterior wall. The openings shall communicate directly with the outdoors and shall have a minimum free area of 1/2 square foot per 1,000 cubic feet (1.7 m^2/1000 m^3) of garage volume.

M1307.4.1.2 Louvers and grilles. In calculating free area required by Section M1307.4.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have a 25-percent free area and metal louvers and grilles will have a 75-percent free area. Louvers and grilles shall be fixed in the open position.

M1307.4.2 Mechanical ventilation. Indoor locations intended for hydrogen-generating or refueling operations shall be ventilated in accordance with Section 502.16 of the *International Mechanical Code*. In these locations, *equipment* and *appliances* having an *ignition source* shall be located so that the source of ignition is below the mechanical *ventilation* outlet(s).

M1307.4.3 Specially engineered installations. As an alternative to the provisions of Sections M1307.4.1 and M1307.4.2, the necessary supply of air for *ventilation* and dilution of flammable gases shall be provided by an *approved* engineered system.

M1307.5 Electrical appliances. Electrical *appliances* shall be installed in accordance with Chapters 14, 15, 19, 20 and 34 through 43.

M1307.6 Plumbing connections. Potable water and drainage system connections to *equipment* and *appliances* regulated by this code shall be in accordance with Chapters 29 and 30.

M1307.7 Prohibited support. Gypsum board shall not be used as a support base under an *appliance*.

M1411.3.1.2 Appliance, equipment and insulation in pans. Where *appliances*, *equipment* or insulation are subject to water damage when auxiliary drain pans fill, that portion of the *appliance*, *equipment* and insulation shall be installed above the rim of the pan. Supports located inside of the pan to support the *appliance* or *equipment* shall be water resistant and *approved*.

M1411.3.2 Drain pipe materials and sizes. Components of the condensate disposal system shall be ABS, cast iron, copper, cross-linked polyethylene, CPVC, galvanized steel, PE-RT, polyethylene, polypropylene or PVC pipe or tubing. Components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the applicable provisions of Chapter 30. Condensate waste and drain line size shall be not less than 3/4-inch (19 mm) nominal diameter from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an *approved* method.

M1411.3.3 Drain line maintenance. Condensate drain lines shall be configured to permit the clearing of blockages and performance of maintenance without requiring the drain line to be cut.

M1411.3.4 Appliances, equipment and insulation in pans. Where *appliances, equipment* or insulation are subject to water damage when auxiliary drain pans fill, those portions of the *appliances, equipment* and insulation shall be installed above the flood level rim of the pan. Supports located inside of the pan to support the *appliance* or *equipment* shall be water resistant and *approved*.

M1411.4 Condensate pumps. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the *appliance* or *equipment* served such that when the pump fails, the *appliance* or *equipment* will be prevented from operating. Pumps shall be installed in accordance with the manufacturer's instructions.

M1411.5 Auxiliary drain pan. Category IV condensing *appliances* shall have an auxiliary drain pan where damage to any building component will occur as a result of stoppage in the condensate drainage system. These pans shall be installed in accordance with the applicable provisions of Section M1411.3.

Exception: Fuel-fired *appliances* that automatically shut down operation in the event of a stoppage in the condensate drainage system.

M1411.6 Insulation of refrigerant piping. Piping and fittings for refrigerant vapor (suction) lines shall be insulated with insulation having a thermal resistivity of not less than R-3 and having external surface permeance not exceeding 0.05 perm [2.87 ng/(s × m^2 × Pa)] when tested in accordance with ASTM E96.

M1411.6.1 Refrigerant line insulation protection. Refrigerant piping insulation shall be protected in accordance with Section N1103.4.1.

M1411.7 Location and protection of refrigerant piping. Refrigerant piping installed within 1-1/2 inches (38 mm) of the underside of *roof decks* shall be protected from damage caused by nails and other fasteners.

M1411.8 Support of refrigerant piping. Refrigerant piping and tubing shall be securely fastened to a permanent support within 6 feet (1829 mm) of the condensing unit.

M1411.9 Locking access port caps. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

SECTION M1412
ABSORPTION COOLING EQUIPMENT

M1412.1 Approval of equipment. Absorption systems shall be installed in accordance with the manufacturer's instructions. Absorption *equipment* shall comply with UL 1995 or UL/CSA/ANCE 60335-2-40.

M1412.2 Condensate disposal. Condensate from the cooling coil shall be disposed of as provided in Section M1411.3.

M1412.3 Insulation of piping. Refrigerant piping, brine piping and fittings within a building shall be insulated to prevent condensation from forming on piping.

M1412.4 Pressure-relief protection. Absorption systems shall be protected by a pressure-relief device. Discharge from the pressure-relief device shall be located where it will not create a hazard to persons or property.

SECTION M1413
EVAPORATIVE COOLING EQUIPMENT

[W][S] M1413.1 General. Evaporative cooling *equipment* and *appliances* shall comply with UL 1995 or UL/CSA/ANCE 60335-2-40 and shall be installed:

1. In accordance with the manufacturer's instructions.

2. On level platforms in accordance with Section M1305.1.3.1.
3. So that openings in exterior walls are flashed in accordance with Section R703.4.
4. So as to protect the potable water supply in accordance with Section ((~~P2902~~)) 603 of the *Uniform Plumbing Code*.
5. So that air intake opening locations are in accordance with Section R303.5.1.

SECTION M1414
FIREPLACE STOVES

M1414.1 General. Fireplace stoves shall be *listed*, *labeled* and installed in accordance with the terms of the listing. Fireplace stoves shall be tested in accordance with UL 737.

M1414.2 Hearth extensions. Hearth extensions for fireplace stoves shall be installed in accordance with the *listing* of the fireplace stove. The supporting structure for a hearth extension for a fireplace stove shall be at the same level as the supporting structure for the fireplace unit. The hearth extension shall be readily distinguishable from the surrounding floor area.

SECTION M1415
MASONRY HEATERS

M1415.1 General. *Masonry heaters* shall be constructed in accordance with Section R1002.

M1502.4.6 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Sections M1502.4.6.1 through M1502.4.6.3.

M1502.4.6.1 Specified length. The maximum length of the exhaust duct shall be 35 feet (10 668 mm) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table M1502.4.6.1. The maximum length of the exhaust duct does not include the transition duct.

TABLE M1502.4.6.1
DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH

DRYER EXHAUST DUCT FITTING TYPE	EQUIVALENT LENGTH
4-inch radius mitered 45-degree elbow	2 feet 6 inches
4-inch radius mitered 90-degree elbow	5 feet
6-inch radius smooth 45-degree elbow	1 foot
6-inch radius smooth 90-degree elbow	1 foot 9 inches
8-inch radius smooth 45-degree elbow	1 foot
8-inch radius smooth 90-degree elbow	1 foot 7 inches
10-inch radius smooth 45-degree elbow	9 inches
10-inch radius smooth 90-degree elbow	1 foot 6 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

M1502.4.6.2 Manufacturer's instructions. The size and maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer at the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table M1502.4.6.1 shall be used.

M1502.4.6.3 Dryer exhaust duct power ventilator. The maximum length of the exhaust duct shall be determined in accordance with the manufacturer's instructions for the dryer exhaust duct power ventilator.

M1502.4.7 Length identification. Where the exhaust duct equivalent length exceeds 35 feet (10 668 mm), the equivalent length of the exhaust duct shall be identified on a permanent *label* or tag. The *label* or tag shall be located within 6 feet (1829 mm) of the exhaust duct connection.

M1502.4.8 Exhaust duct required. Where space for a clothes dryer is provided, an exhaust *duct system* shall be installed. Where the clothes dryer is not installed at the time of occupancy the exhaust duct shall be capped or plugged in the space in which it originates and identified and marked "future use."

Exception: Where a *listed* condensing clothes dryer is installed prior to occupancy of the structure.

M1502.5 Protection required. Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of framing members where there is less than 1-1/4 inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, shall have a minimum thickness of 0.062 inch (1.6 mm) and shall extend not less than 2 inches (51 mm) above sole plates and below top plates.

SECTION M1503
DOMESTIC COOKING EXHAUST EQUIPMENT

M1503.1 General. Domestic cooking exhaust equipment shall comply with the requirements of this section.

M1503.2 Domestic cooking exhaust. Where domestic cooking exhaust equipment is provided, it shall comply with one of the following:

1. The fan for overhead range hoods and downdraft exhaust equipment not integral with the cooking *appliance* shall be *listed* and *labeled* in accordance with UL 507.
2. Overhead range hoods and downdraft exhaust equipment with integral fans shall comply with UL 507.
3. Domestic cooking *appliances* with integral downdraft exhaust equipment shall be *listed* and *labeled* in accordance with ANSI Z21.1 or UL 858.
4. Microwave ovens with integral exhaust for installation over the cooking surface shall be *listed* and *labeled* in accordance with UL 923.

[W] M1503.2.1 Open-top broiler exhaust. Domestic open-top broiler units shall be provided with a metal exhaust hood having a thickness of not less than 0.0157 inch (0.3950 mm) (No. 28 gage). Such hoods shall be installed with a clearance of not less than 1/4 inch (6.4 mm) between the hood and the underside of *combustible material* and cabinets. A clearance of

not less than 24 inches (610 mm) shall be maintained between the cooking surface and *combustible material* and cabinets. The hood width shall be not less than the width of the broiler unit and shall extend over the entire unit.

Exceptions:

1. Broiler units that incorporate an integral exhaust system, and that are *listed* and *labeled* for use without an exhaust hood. ((,))
2. Broiler units permanently installed outside the building envelope and having the cooking surface at least 5′0″ below a 1-hour fire resistance rated ceiling, shall not be required to have an exhaust hood.

[W] M1503.3 Exhaust discharge. Domestic cooking exhaust equipment shall discharge to the outdoors through a duct. The duct shall have a smooth interior surface, shall be airtight, shall be equipped with a backdraft damper and shall be independent of all other exhaust systems. Ducts serving domestic cooking exhaust equipment shall not terminate in an attic or *crawl space* or areas inside the building.

Exception: Where installed in accordance with the manufacturer's instructions, and where ((~~mechanical or natural *ventilation* is otherwise provided~~)) continuous local exhaust is provided in an enclosed kitchen in accordance with Table M1505.4.4.1, *listed* and *labeled* ductless range hoods shall not be required to discharge to the outdoors.

M1503.4 Duct material. Ducts serving domestic cooking exhaust equipment shall be constructed of galvanized steel, stainless steel or copper.

Exception: Ducts for domestic kitchen cooking *appliances* equipped with down-draft exhaust systems shall be permitted to be constructed of schedule 40 PVC pipe and fittings provided that the installation complies with all of the following:

1. The duct is installed under a concrete slab poured on grade.
2. The underfloor trench in which the duct is installed is completely backfilled with sand or gravel.
3. The PVC duct extends not more than 1 inch (25 mm) above the indoor concrete floor surface.
4. The PVC duct extends not more than 1 inch (25 mm) above grade outside of the building.
5. The PVC ducts are solvent cemented.

[W] M1503.5 Kitchen exhaust rates. Where domestic kitchen cooking *appliances* are ((~~equipped~~)) provided with ((~~ducted range hoods or down-draft~~)) exhaust ((~~systems~~)) equipment, the fans shall be sized in accordance with Section M1505.4.4.1.

M1503.6 Makeup air required. Where one or more gas, liquid or solid fuel-burning *appliance* that is neither direct-vent nor uses a mechanical draft venting system is located within a dwelling unit's air barrier, each exhaust system capable of exhausting in excess of 400 cubic feet per minute (0.19 m^3/s) shall be mechanically or passively provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with not fewer than one damper complying with Section M1503.6.2.

Exception: Makeup air is not required for exhaust systems installed for the exclusive purpose of space cooling and intended to be operated only when windows or other air inlets are open.

M1503.6.1 Location. Kitchen exhaust makeup air shall be discharged into the same room in which the exhaust system is located or into rooms or *duct systems* that communicate through one or more permanent openings with the room in which such exhaust system is located. Such permanent openings shall have a net cross-sectional area not less than the required area of the makeup air supply openings.

M1503.6.2 Makeup air dampers. Where makeup air is required by Section M1503.6, makeup air dampers shall comply with this section. Each damper shall be a gravity damper or an electrically operated damper that automatically opens when the exhaust system operates. Dampers shall be located to allow access for inspection, service, repair and replacement without removing permanent construction or any other ducts not connected to the damper being inspected, serviced, repaired or replaced. Gravity or barometric dampers shall not be used in passive makeup air systems except where the dampers are rated to provide the design makeup airflow at a pressure differential of 0.01 in. w.c. (3 Pa) or less.

SECTION M1504
EXHAUST DUCTS AND EXHAUST OPENINGS

M1504.1 Duct construction. Where exhaust duct construction is not specified in this chapter, construction shall comply with Chapter 16.

M1504.2 Duct length. The length of exhaust and supply ducts used with ventilating *equipment* shall not exceed the lengths determined in accordance with Table M1504.2.

Exception: Duct length shall not be limited where the *duct system* complies with the manufacturer's design criteria or where the flow rate of the installed ventilating *equipment* is verified by the installer or *approved* third party using a flow hood, flow grid or other airflow measuring device.

EXHAUST SYSTEMS

TABLE M1504.2
DUCT LENGTH

DUCT TYPE	FLEX DUCT								SMOOTH-WALL DUCT							
Fan airflow rating (CFM @ 0.25 inch wc[a])	50	80	100	125	150	200	250	300	50	80	100	125	150	200	250	300
Diameter[b] (inches)	Maximum length[c, d, e] (feet)															
3	X	X	X	X	X	X	X	X	5	X	X	X	X	X	X	X
4	56	4	X	X	X	X	X	X	114	31	10	X	X	X	X	X
5	NL	81	42	16	2	X	X	X	NL	152	91	51	28	4	X	X
6	NL	NL	158	91	55	18	1	X	NL	NL	NL	168	112	53	25	9
7	NL	NL	NL	NL	161	78	40	19	NL	NL	NL	NL	NL	148	88	54
8 and above	NL	NL	NL	NL	NL	189	111	69	NL	NL	NL	NL	NL	NL	198	133

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Fan airflow rating shall be in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51.

b. For noncircular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.

c. This table assumes that elbows are not used. Fifteen feet of allowable duct length shall be deducted for each elbow installed in the duct run.

d. NL = no limit on duct length of this size.

e. X = not allowed. Any length of duct of this size with assumed turns and fittings will exceed the rated pressure drop.

[W] M1504.3 Exhaust openings. Air exhaust openings shall terminate as follows:

1. Not less than 3 feet (914 mm) from property lines.
2. Not less than 3 feet (914 mm) from gravity air intake openings, operable windows and doors.
3. Not less than 10 feet (3048 mm) from mechanical air intake openings except where either of the following apply:
   - 3.1. ((~~the~~)) The exhaust opening is located not less than 3 feet (914 mm) above the air intake opening.
   - 3.2. The exhaust opening is part of a factory-built intake/exhaust combination termination fitting installed in accordance with the manufacturer's instructions, and the exhaust air is drawn from a living space.
4. Openings shall comply with Sections R303.5.2 and R303.6.

SECTION M1505
MECHANICAL VENTILATION

[W] M1505.1 General. Where local exhaust or whole-house mechanical *ventilation* is provided, the ventilation system shall be designed in accordance with this section.

Exception: Alternate balanced whole-house ventilation systems and local exhaust systems designed and commissioned in accordance with ASHRAE 62.2 are permitted.

M1505.2 Recirculation of air. Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or circulated to another *dwelling unit* and shall be exhausted directly to the outdoors. Exhaust air from bathrooms, toilet rooms and kitchens shall not discharge into an attic, *crawl space* or other areas inside the building. This section shall not prohibit the installation of ductless range hoods in accordance with the exception to Section M1503.3.

M1505.3 Exhaust equipment. Exhaust fans and whole-house mechanical ventilation fans shall be *listed* and *labeled* as providing the minimum required airflow in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51.

[W] M1505.4 Whole-house mechanical ventilation system. Each dwelling unit shall be equipped with a ventilation system. ((~~Whole~~)) The whole-house mechanical ventilation systems shall be designed in accordance with Sections M1505.4.1 through M1505.4.4.

M1505.4.1 System design. The whole-house ventilation system shall consist of one or more supply fans, one or more ((~~or~~)) exhaust fans, or ((~~a combination of such~~)) an ERV/HRV with integral fans, and associated ducts and controls. Whole-house mechanical ventilation system supply and exhaust fans shall meet the requirements of Sections M1505.4.1.2, M1505.4.1.3, M1505.4.1.4, and M1505.4.1.5. Local exhaust or supply fans are permitted to serve as ((~~such a~~)) part of the whole-house ventilation system when provided with the proper controls per Section M1505.4.2. ((~~Outdoor air ducts connected to the return side of an air handler shall be considered as providing supply ventilation.~~)) The systems shall be designed and installed to exhaust and/or supply the minimum outdoor airflow rates in accordance with Section M1505.4.3 as modified by whole-house ventilation system coefficients in Section M1505.4.3.1 where applicable. The whole-house ventilation system shall operate continuously at the minimum ventilation rate determined per Section M1505.4.2 unless configured with intermittent off controls per Section M1505.4.3.2.

M1505.4.1.1 Whole-house system component requirements. Whole-house ventilation supply and exhaust fans specified in this section shall have a minimum efficacy as prescribed in the Washington State Energy Code. Design and installation of the system or equipment shall be carried out in accordance with manufacturers' installation instructions. Whole-house ventilation fans shall be rated for sound at no less than the minimum airflow rate required by Section M1505.4.3.1. Ventilation fans shall be rated for sound at a maximum of 1.0 sone. This sound rating shall be at a minimum of 0.1 in. w.c. (25 Pa) static pressure in accordance with HVI procedures specified in Sections M1505.4.1.2 and M1505.4.1.3.

Exception: HVAC air handlers, ERV/HRV units, and remote mounted fans need not meet the sound requirements. To be considered for this exception, a remote mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways, and there must be at least 4 ft (1.3 m) of ductwork between the fan and the intake grille.

The whole-house supply fan shall provide ducted outdoor ventilation air to each habitable space within the residential unit.

Exception: Interior joining spaces provided with a 30 cfm whole-house transfer fan or a permanent opening with an area of not less than 8 percent of the floor area of the interior adjoining space but not less than 25 square feet do not require ducted outdoor ventilation air to be supplied directly to the space. Whole-house transfer fans shall meet the sone rating of Section M1505.4.1.1 and shall have whole-house ventilation controls that comply with Section M1505.4.2.

M1505.4.1.2 Exhaust fans. Exhaust fans required shall be ducted directly to the outside. Exhaust air outlets shall be designed to limit the pressure difference to the outside and equipped with backdraft dampers or motorized dampers in accordance with the Washington State Energy Code. Exhaust fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure, as applicable). Exhaust fans required in this section may be used to provide local ventilation. Bathroom exhaust fans that are designed for intermittent exhaust airflow rates higher than the continuous exhaust airflow rates in Table M1505.4.3.2 shall be provided with occupancy sensors or humidity sensors to automatically override the fan to the high speed airflow rate. The exhaust fans shall be tested and the testing results shall be submitted and posted in accordance with Section M1505.4.1.6.

M1505.4.1.3 Supply fans. Supply fans used in meeting the requirements of this section shall supply outdoor air from intake openings in accordance with IMC Sections 401.4 and 401.5. When designed for intermittent off operation, supply systems shall be equipped with motorized dampers in accordance with the Washington State Energy Code. Supply fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure; HVI 916, HVI Airflow Test Procedure; and HVI 920, HVI Product Performance Certification Procedure, as applicable). Where outdoor air is provided by supply fan systems the outdoor air shall be filtered. The filter shall be accessible for regular maintenance and replacement. The filter shall have a Minimum Efficiency Rating Value (MERV) of at least 8.

M1505.4.1.4 Balanced whole-house ventilation system. A balanced whole-house ventilation system shall include both supply and exhaust fans. The supply and exhaust fans shall have airflow that is within 10 percent of each other. The tested and balanced total mechanical exhaust airflow rate is within 10 percent or 5 cfm, whichever is greater, of the total mechanical supply airflow rate. The flow rate test results shall be submitted and posted in accordance with Section M1505.4.1.7. The exhaust fan shall meet the requirements of Section M1505.4.1.2. The supply fan shall meet the requirements of Section M1505.4.1.3. Balanced ventilation systems with both supply and exhaust fans in a packaged product, such as an ERV/HRV shall meet the requirements of HVI 920, as applicable. Local exhaust systems that are not a component of the whole-house mechanical ventilation system are exempt from the balanced airflow calculation.

M1505.4.1.5 Furnace integrated supply. Systems using space heating and/or cooling air handler fans for outdoor air supply distribution are not permitted.

Exception: Air handler fans shall have multispeed or variable speed supply airflow control capability with a low speed operation not greater than 25 percent of the rated supply airflow capacity during ventilation only operation. Outdoor air intake openings must meet the provisions of Sections R303.5 and R303.6 and must include a motorized damper that is activated by the whole-house ventilation system controller. The motorized damper must be controlled to maintain the outdoor airflow intake airflow within 10 percent of the whole-house mechanical exhaust airflow rate. The flow rate for the outdoor air intake must be tested and verified at the minimum ventilation fan speed and the maximum heating or cooling fan speed. The results of the test shall be submitted and posted in accordance with Section M1505.4.1.7.

M1505.4.1.6 Testing. Whole-house mechanical ventilation systems shall be tested, balanced and verified to provide a flow rate not less than the minimum required by Sections M1505.4.3 and M1505.4.4.1. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals, outlet terminals or grilles or in the connected ventilation ducts. Where required by the building official, testing shall be conducted by an approved third party. A written

report of the results of the test shall be signed by the party conducting the test and provided to the building official and be posted in the dwelling unit per Section M1505.4.1.7.

M1505.4.1.7 Certificate. A permanent certificate shall be completed by the mechanical contractor, test and balance contractor or other approved party and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall list the flow rate determined from the delivered airflow of the whole-house mechanical ventilation system as installed and the type of mechanical whole-house ventilation system used to comply with Section M1505.4.3.1.

[W] M1505.4.2 System controls. The whole-house mechanical ventilation system shall be provided with controls that ((~~enable manual override.~~)) comply with the following:

1. The whole-house ventilation system shall be controlled with manual switches, timers or other means that provide for automatic operation of the ventilation system that are readily accessible by the occupant;
2. Whole-house mechanical ventilation system shall be provided with controls that enable manual override off of the system by the occupant during periods of poor outdoor air quality. Controls shall include permanent text or a symbol indicating their function. Recommended control permanent labeling to include text similar to the following: "Leave on unless outdoor air quality is very poor." Manual controls shall be readily accessible by the occupant;
3. Whole-house ventilation systems shall be configured to operate continuously except where intermittent off controls and sizing are provided per Section M1505.4.3.2.

((~~Controls shall include text or a symbol indicating their function.~~))

[W] M1505.4.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate ((~~not less than that~~)) as determined in accordance with Table M1505.4.3(1) or ((~~not less than that determined by~~)) Equation 15-1.

Ventilation rate in cubic feet per minute = (0.01 × total square foot area of house) +
[7.5 × (number of bedrooms + 1)] **(Equation 15-1)**

((~~Exceptions:~~

1. ~~Ventilation rate credit. The minimum mechanical ventilation rate determined in accordance with Table M1505.4.3(1) or Equation 15-1 shall be reduced by 30 percent, provided that both of the following conditions apply:~~
   - 1.1. ~~A ducted system supplies ventilation air directly to each bedroom and to one or more of the following rooms:~~
     - 1.1.1. ~~Living room.~~
     - 1.1.2. ~~Dining room.~~
     - 1.1.3. ~~Kitchen.~~
   - 1.2. ~~The whole-house ventilation system is a balanced ventilation system.~~
2. ~~Programmed intermittent operation. The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25 percent of each 4-hour segment and the ventilation rate prescribed in Table M1505.4.3(1), by Equation 15-1 or by Exception 1 is multiplied by the factor determined in accordance with Table M1505.4.3(2).~~))

((~~TABLE M1505.4.3(1)~~
~~CONTINUOUS WHOLE HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS~~

~~DWELLING UNIT FLOOR AREA (square feet)~~	~~NUMBER OF BEDROOMS~~				
	~~0–1~~	~~2–3~~	~~4–5~~	~~6–7~~	~~> 7~~
	~~Airflow in CFM~~				
~~< 1,500~~	~~30~~	~~45~~	~~60~~	~~75~~	~~90~~
~~1,501–3,000~~	~~45~~	~~60~~	~~75~~	~~90~~	~~105~~
~~3,001–4,500~~	~~60~~	~~75~~	~~90~~	~~105~~	~~120~~
~~4,501–6,000~~	~~75~~	~~90~~	~~105~~	~~120~~	~~135~~
~~6,001–7,500~~	~~90~~	~~105~~	~~120~~	~~135~~	~~150~~
~~> 7,500~~	~~105~~	~~120~~	~~135~~	~~150~~	~~165~~

~~For SI: 1 square foot = 0.0929 m^2, 1 cubic foot per minute = 0.0004719 m^3/s.~~))

TABLE M1505.4.3(1)
WHOLE-HOUSE MECHANICAL VENTILATION AIRFLOW RATE

DWELLING UNIT FLOOR AREA (SQUARE FEET)	NUMBER OF BEDROOMS				
	0 - 1	2	3	4	5 OR MORE
	AIRFLOW IN CFM				
< 500	30	30	35	45	50
501 – 1,000	30	35	40	50	55
1,001 – 1,500	30	40	45	55	60
1,501 – 2,000	35	45	50	60	65
2,001 – 2,500	40	50	55	65	70
2,501 – 3,000	45	55	60	70	75
3,001 – 3,500	50	60	65	75	80
3,501 – 4,000	55	65	70	80	85
4,001 – 4,500	60	70	75	85	90
4,501 – 5,000	65	75	80	90	95

M1505.4.3.1 Ventilation quality adjustment. The minimum whole-house ventilation rate from Section 1505.4.3 shall be adjusted by the system coefficient in Table M1505.4.3(2) based on the system type not meeting the definition of a balanced whole-house ventilation system and/or not meeting the definition of a distributed whole-house ventilation system.

$$Q_v = Q_r \times C_{system}$$ **(Equation 15-2)**

Where:

Q_v = Quality-adjusted ventilation airflow rate in cubic feet per minute (cfm).
Q_r = Ventilation airflow rate, cubic feet per minute (cfm) from 15-1 or Table M1505.4.3(1).
C_{system} = System coefficient from Table M1505.4.3(2).

TABLE M1505.4.3(2)
SYSTEM COEFFICIENT (C_{system})

SYSTEM TYPE	DISTRIBUTED	NOT DISTRIBUTED
Balanced	1.0	1.25
Not balanced	1.25	1.5

M1505.4.3.2 Intermittent off operation. Whole-house mechanical ventilation systems shall be provided with advanced controls that are configured to operate the system with intermittent off operation shall operate for a least two hours in each four-hour segment. The whole-house ventilation airflow rate determined in accordance with Section M1505.4.3 as corrected by Section M1505.4.3.1 is multiplied by the factor determined in accordance with Table M1505.4.2.

TABLE ((~~M1505.4.3(2)~~)) M1505.4.3.2
INTERMITTENT OFF WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	((~~25%~~))	((~~33%~~))	50%	66%	75%	100%
Factor[a]	((4))	((3))	2	1.5	1.3	1.0

a. For ventilation system run-time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

[W] M1505.4.4 Local exhaust rates. *Local exhaust* systems shall be designed to have the capacity to exhaust the minimum airflow rate determined in accordance with Table M1505.4.4.1. If the local exhaust fan is included in the whole-house ventilation system, in accordance with Section 1505.4.1, then the exhaust fan shall be controlled to operate as specified in Section M1505.4.2.

M1505.4.4.1 Local exhaust. Bathrooms, toilet rooms, and kitchens shall include a local exhaust system. Such local exhaust systems shall have the capacity to exhaust the minimum airflow rate in accordance with Table M1505.4.4.1. Fans required by this section shall be provided with controls that enable manual override or automatic occupancy sensor, humidity sensor, timer controls, or pollutant sensor controls. An "on/off" switch shall meet this requirement for manual controls. Manual fan controls shall be readily accessible in the room served by the fan.

EXHAUST SYSTEMS

[W] TABLE M1505.4.4.1
MINIMUM ((~~REQUIRED~~)) LOCAL EXHAUST RATES ((~~FOR ONE- AND TWO-FAMILY DWELLINGS~~))

AREA TO BE EXHAUSTED	EXHAUST RATES[a]	
	INTERMITTENT	CONTINUOUS
((~~Kitchens~~	~~100 cfm intermittent or 25 cfm continuous~~))	—
Open Kitchens	In accordance with Section M1505.4.4.3	Not permitted
Enclosed Kitchens	In accordance with Section M1505.4.4.3	5 ACH based on kitchen volume
Bathrooms-Toilet Rooms	((~~Mechanical exhaust capacity of~~)) 50 cfm ((~~intermittent or 20 cfm continuous~~))	20 cfm

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 inch water column = 0.2488 kPa.

a. The listed exhaust rate for bathrooms-toilet rooms shall equal or exceed the exhaust rate at a minimum static pressure of 0.25 inch water column in accordance with Section M1505.3.

M1505.4.4.2 Local exhaust fans. Exhaust fans shall meet the following criteria:

1. Exhaust fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure; HVI 916, HVI Airflow Test Procedure; and HVI 920, HVI Product Performance Certification Procedure).
2. Fan airflow rating and duct system shall be designed and installed to deliver at least the exhaust airflow required by Table M1505.4.4.1. The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device. Local exhaust systems shall be tested, balanced, and verified to provide a flow rate not less than the minimum required by this section.
3. Design and installation of the system or equipment shall be carried out in accordance with manufacturers' installation instructions.
4. Intermittent local exhaust systems serving kitchens shall be rated for sound at a maximum of 3 sones at one or more airflow settings not less than 100 cfm at a static pressure not less than that determined at working speed as specified in HVI 916 Section 7.2.
5. Continuous local exhaust systems serving kitchens shall be rated for sound at a maximum of 1 sones at one or more airflow settings not less than 100 cfm at a static pressure not less than that determined at working speed as specified in HVI 916 Section 7.2.

Exceptions:

1. The installed airflow is not required to be field-verified where exhaust airflow rating at a pressure of 0.25 in. w.g. is used, provided the duct sizing meets the prescriptive requirements of Table M1505.4.4.2.
2. Remote mounted fans need not meet sound requirements. To be considered for this exception, a remote mounted fan shall be mounted outside the kitchen, and there shall be at least 4 feet (1.5 m) of ductwork between the fan and the intake grille.

TABLE M1505.4.4.2
PRESCRIPTIVE EXHAUST DUCT SIZING

FAN TESTED CFM AT 0.25 INCHES W.G.	MINIMUM FLEX DIAMETER	MAXIMUM LENGTH IN FEET	MINIMUM SMOOTH DIAMETER	MAXIMUM LENGTH IN FEET	MAXIMUM ELBOWS[a]
50	4 inches	25	4 inches	70	3
50	5 inches	90	5 inches	100	3
50	6 inches	No Limit	6 inches	No Limit	3
80	4 inches[b]	NA	4 inches	20	3
80	5 inches	15	5 inches	100	3
80	6 inches	90	6 inches	No Limit	3
100	5 inches[b]	NA	5 inches	50	3
100	6 inches	45	6 inches	No Limit	3
125	6 inches	15	6 inches	No Limit	3
125	7 inches	70	7 inches	No Limit	3

a. For each additional elbow, subtract 10 feet from length.
b. Flex ducts of this diameter are not permitted with fans of this size.

M1505.4.4.3 Local intermittent kitchen exhaust system. Kitchen range hoods for domestic cooking appliances shall meet or exceed either the minimum airflow or the minimum capture efficiency in accordance with Table M1505.4.4.3. Capture efficiency ratings shall be determined in accordance with ASTM E3087.

Exception: Other intermittent kitchen exhaust fans, including downdraft, shall meet or exceed 300 cfm airflow.

TABLE M1505.4.4.3
KITCHEN RANGE HOOD AIRFLOW RATES (cfm) AND ASTM E3087
CAPTURE EFFICIENCY (CE) RATINGS ACCORDING TO KITCHEN RANGE FUEL TYPE

HOOD OVER ELECTRIC RANGE	HOOD OVER COMBUSTION RANGE
60% CE or 160 cfm	80% CE or 250 cfm

M1505.4.4.3.1 Field verification and diagnostic testing for local intermittent kitchen exhaust system. The local exhaust system for kitchens shall be installed to comply with local mechanical exhaust requirements specified in Section M1505.4.4.3 and shall be field-verified in accordance with the procedures below to confirm the model is rated by HVI or AHAM to comply with the following requirements:

1. Local intermittent exhaust systems for kitchens shall be tested and verified to provide a minimum airflow rate or capture efficiency required by Table M1505.4.4.3. Testing shall include verification of the maximum sound rating as specified in Section M1505.4.4.3.2. Testing for the intermittent kitchen exhaust systems shall occur with the whole-house ventilation system operating and with all dwelling unit or sleeping unit entry doors closed. Testing for exhaust systems that require makeup air in accordance with Section M1503.6 shall include verifying that the mechanical makeup air system is controlled to automatically start. Testing for exhaust systems that do not require mechanical makeup air in accordance with Section M1503.6 and that are exempt from pressurize equalization shall be tested with operable openings manually opened unless design exhaust airflow can be achieved with all operable openings closed. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood, flow grid, or other airflow measuring device. Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official.

   Exception: The installed airflow is not required to be field-verified where an exhaust airflow rating at a pressure of 0.25 in. w.g. is used, provided the duct sizing meets the prescriptive requirements of Table M1505.4.4.2.

2. The verification shall utilize certified rating data from the HVI Publication 911: Certified Home Ventilating Products Directory, AHAM-Certified Range Hood Directory, or another directory of certified product performance ratings approved by code official for determining compliance. The verification procedure shall consist of visual inspection of the local intermittent kitchen exhaust system to verify and record the following information:
   2.1. The manufacturer name and model number.
   2.2. The model is listed in the HVI, AHAM or equivalent directory.
   2.3. The rated airflow value listed in the HVI, AHAM or equivalent directory.
   2.4. The sound rating value listed in the HVI Directory.
   2.5. If the value for the rated airflow given in the directory is greater than or equal to the airflow requirements specified in Section M1505.4.4.3 and if the value for the sone rating given in the directory is less than or equal to the sone rating requirements specified in Section M1505.4.4.2, then the local intermittent kitchen exhaust system complies, otherwise the local intermittent kitchen exhaust system does not comply.

CHAPTER 16

DUCT SYSTEMS

User notes:

About this chapter: *Chapter 16 addresses duct construction for HVAC and most exhaust systems. This chapter covers duct materials, duct construction, duct installation, duct insulation properties, duct sealing, above-ground and underground ducts, return air intake locations and air plenums.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M1601
DUCT CONSTRUCTION

M1601.1 Duct design. *Duct systems* serving heating, cooling and *ventilation equipment* shall be installed in accordance with the provisions of this section and ACCA *Manual D*, the *appliance* manufacturer's installation instructions or other *approved* methods.

[W] M1601.1.1 Above-ground duct systems. Above-ground *duct systems* shall conform to the following:

1. *Equipment* connected to *duct systems* shall be designed to limit discharge air temperature to not greater than 250°F (121°C).
2. Factory-made ducts shall be *listed* and *labeled* in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Fibrous glass duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards.*
4. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the SMACNA *HVAC Duct Construction Standards—Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A653.
5. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. *Duct systems* shall be constructed of materials having a flame spread index of not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists shall not be used as a duct or an air plenum in new construction. For existing systems, stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
   7.1. These cavities or spaces shall not be used as a plenum for supply air.
   7.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
   7.3. Stud wall cavities shall not convey air from more than one floor level.
   7.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting fireblocking in accordance with Section R302.11. Fireblocking materials used for isolation shall comply with Section R302.11.1.
   7.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.
   7.6. Building cavities used as plenums shall be sealed.
8. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

CHAPTER 17
COMBUSTION AIR

User notes:

About this chapter: *Chapter 17 applies only to oil-fired and solid fuel-fired appliances. Chapter 24 applies to combustion air for gas-fired appliances.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M1701
GENERAL

[W] M1701.1 Scope. Solid fuel-burning *appliances* shall be provided with *combustion air* in accordance with the *appliance* manufacturer's installation instructions. Oil-fired *appliances* shall be provided with *combustion air* in accordance with NFPA 31. The methods of providing *combustion air* in this chapter do not apply to fireplaces, fireplace stoves and direct-vent *appliances*. The requirements for combustion and dilution air for gas-fired *appliances* shall be in accordance with Chapter 24.

Fireplaces shall comply with Chapter 10.

M1701.2 Opening location. In flood hazard areas as established in Table R301.2, *combustion air* openings shall be located at or above the elevation required in Section R322.2.1 or R322.3.2.

CHAPTER 20
BOILERS AND WATER HEATERS

User notes:

About this chapter: *Chapter 20 is specific to boilers and water heaters. The provisions of this chapter apply to appliances generally without regard to the energy source. Gas-fired boilers and water heaters are also addressed in Chapter 24; therefore, Chapters 20 and 24 both apply to such appliances.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M2001
BOILERS

[S] ((~~M2001.1 Installation.~~ ~~In addition to the requirements of this code, the installation of boilers shall conform to the manufacturer's instructions. The manufacturer's rating data, the nameplate and operating instructions of a permanent type shall be attached to the boiler. Boilers shall have their controls set, adjusted and tested by the installer. A complete control diagram together with complete boiler operating instructions shall be furnished by the installer. Solid and liquid fuel-burning boilers shall be provided with *combustion air* as required by Chapter 17.~~

~~**M2001.1.1 Standards.** Packaged oil-fired boilers shall be *listed* and *labeled* in accordance with UL 726. Packaged electric boilers shall be *listed* and *labeled* in accordance with UL 834. Solid fuel-fired boilers shall be *listed* and *labeled* in accordance with UL 2523. Boilers shall be designed, constructed and certified in accordance with the *ASME Boiler and Pressure Vessel Code*, Section I or IV. Controls and safety devices for boilers with fuel input ratings of 12,500,000 Btu/hr (3663 kW) or less shall meet the requirements of ASME CSD-1. Gas-fired boilers shall conform to the requirements listed in Chapter 24.~~))

[S] M2001.1 Boilers. Boilers shall comply with the *Seattle Boiler and Pressure Vessel Code*.

((~~M2001.2 Clearance.~~ ~~Boilers shall be installed in accordance with their *listing* and *label*.~~

~~M2001.3 Valves.~~ ~~Every boiler or modular boiler shall have a shutoff valve in the supply and return piping. For multiple boiler or multiple modular boiler installations, each boiler or modular boiler shall have individual shutoff valves in the supply and return piping.~~

~~**Exception:** Shutoff valves are not required in a system having a single low-pressure steam boiler.~~

~~M2001.4 Flood-resistant installation.~~ ~~In flood hazard areas established in Table R301.2, boilers, water heaters and their control systems shall be located or installed in accordance with Section R322.1.6.~~))

[S] ((~~SECTION M2002~~
~~OPERATING AND SAFETY CONTROLS~~

~~M2002.1 Safety controls.~~ ~~Electrical and mechanical operating and safety controls for boilers shall be *listed* and *labeled*.~~

~~M2002.2 Hot water boiler gauges.~~ ~~Every hot water boiler shall have a pressure gauge and a temperature gauge, or combination pressure and temperature gauge. The gauges shall indicate the temperature and pressure within the normal range of the system's operation.~~

~~M2002.3 Steam boiler gauges.~~ ~~Every steam boiler shall have a water gauge glass and a pressure gauge. The pressure gauge shall indicate the pressure within the normal range of the system's operation. The gauge glass shall be installed so that the midpoint is at the normal water level.~~

~~M2002.4 Pressure relief valve.~~ ~~Boilers shall be equipped with pressure relief valves with minimum rated capacities for the equipment served. Pressure relief valves shall be set at the maximum rating of the boiler. Discharge shall be piped to drains by gravity to within 18 inches (457 mm) of the floor or to an open receptor.~~

~~M2002.5 Boiler low-water cutoff.~~ ~~Steam and hot water boilers shall be protected with a low-water cutoff control.~~

~~**Exception:** A low-water cutoff is not required for coil-type and water-tube-type boilers that require forced circulation of water through the boiler and that are protected with a flow-sensing control.~~

~~M2002.6 Operation.~~ ~~Low-water cutoff controls and flow-sensing controls required by Section M2002.5 shall automatically stop the combustion operation of the *appliance* when the water level drops below the lowest safe water level as established by~~

~~the manufacturer or when the water circulation flow is less than that required for safe operation of the *appliance*, respectively.~~))

[S] ((~~SECTION M2003 EXPANSION TANKS~~

~~**M2003.1 General.** Hot water boilers shall be provided with expansion tanks. Nonpressurized expansion tanks shall be securely fastened to the structure or boiler and supported to carry twice the weight of the tank filled with water. Provisions shall be made for draining nonpressurized tanks without emptying the system.~~

~~**M2003.1.1 Pressurized expansion tanks.** Pressurized expansion tanks shall be consistent with the volume and capacity of the system. Tanks shall be capable of withstanding a hydrostatic test pressure of two and one-half times the allowable working pressure of the system.~~

~~**M2003.2 Minimum capacity.** The minimum capacity of expansion tanks shall be determined from Table M2003.2.~~

~~**TABLE M2003.2**~~
~~**EXPANSION TANK MINIMUM CAPACITY[a] FOR FORCED HOT WATER SYSTEMS**~~

~~SYSTEM VOLUME[b] (gallons)~~	~~PRESSURIZED DIAPHRAGM TYPE~~	~~NONPRESSURIZED TYPE~~
~~10~~	~~1.0~~	~~1.5~~
~~20~~	~~1.5~~	~~3.0~~
~~30~~	~~2.5~~	~~4.5~~
~~40~~	~~3.0~~	~~6.0~~
~~50~~	~~4.0~~	~~7.5~~
~~60~~	~~5.0~~	~~9.0~~
~~70~~	~~6.0~~	~~10.5~~
~~80~~	~~6.5~~	~~12.0~~
~~90~~	~~7.5~~	~~13.5~~
~~100~~	~~8.0~~	~~15.0~~

~~For SI: 1 gallon = 3.785 L, 1 pound per square inch gauge = 6.895 kPa, °C = [(°F) – 32]/1.8.~~
~~a. Based on average water temperature of 195°F, fill pressure of 12 psig and an operating pressure of not greater than 30 psig.~~
~~b. System volume includes volume of water in boiler, convectors and piping, not including the expansion tank.~~))

SECTION M2004
WATER HEATERS USED FOR SPACE HEATING

M2004.1 General. Water heaters used to supply both potable hot water and hot water for space heating shall be installed in accordance with this chapter, Chapter 24, Chapter 28 and the manufacturer's instructions.

SECTION M2005
WATER HEATERS

[W] M2005.1 General. Water heaters shall be installed in accordance with Chapter ((~~28~~)) 5 of the *State Plumbing Code*, the manufacturer's instructions and the requirements of this code. Water heaters installed in an attic shall comply with the requirements of Section M1305.1.2. Gas-fired water heaters shall comply with the requirements in Chapter 24. Domestic electric water heaters shall comply with UL 174. Oiled-fired water heaters shall comply with UL 732. ((~~Solar thermal water heating systems~~)) Thermal solar water heaters shall comply with Chapter 23 and ((~~ICC 900/SRCC 300~~)) UL 174. Solid fuel-fired water heaters shall comply with UL 2523.

M2005.2 Prohibited locations. Fuel-fired water heaters shall not be installed in a room used as a storage closet. Water heaters located in a bedroom or bathroom shall be installed in a sealed enclosure so that *combustion air* will not be taken from the living space. Installation of direct-vent water heaters within an enclosure is not required.

M2005.2.1 Water heater access. Access to water heaters that are located in an *attic* or underfloor *crawl space* is permitted to be through a closet located in a sleeping room or bathroom where *ventilation* of those spaces is in accordance with this code.

M2005.3 Electric water heaters. Electric water heaters shall be installed in accordance with the applicable provisions of Chapters 34 through 43.

M2005.4 Supplemental water-heating devices. Potable water-heating devices that use refrigerant-to-water heat exchangers shall be *approved* and installed in accordance with the manufacturer's instructions.

HYDRONIC PIPING

TABLE M2101.1—continued
HYDRONIC PIPING AND FITTING MATERIALS

MATERIAL	USE CODE[a]	STANDARD[b]	JOINTS	NOTES
Raised temperature polyethylene (PE-RT) fittings	1, 2, 3	ASTM D3261, ASTM F1807, ASTM F2098, ASTM F2159, ASTM F2735, ASTM F2769, CSA B137.18	Copper crimp/insert fitting, stainless steel clamp, insert fittings	—
Steel pipe	1, 2	ASTM A53, ASTM A106	Brazed, welded, threaded, flanged and mechanical fittings	Joints in concrete shall be welded. Galvanized pipe shall not be welded or brazed.
Steel tubing	1	ASTM A254	Mechanical fittings, welded	—

For SI: °C = [(°F) – 32]/1.8.

a. Use code:
1. Above ground.
2. Embedded in radiant systems.
3. Temperatures below 180°F only.
4. Low-temperature (below 130°F) applications only.
5. Temperatures below 160°F only.

b. Standards as listed in Chapter 44.

M2101.2 System drain down. Hydronic piping systems shall be installed to permit draining of the system. Where the system drains to the plumbing drainage system, the installation shall conform to the requirements of Chapters 25 through 32 of this code.

Exception: The buried portions of systems embedded underground or under floors.

[W] M2101.3 Protection of potable water. The potable water system shall be protected from backflow in accordance with the provisions listed in Section ((~~P2902~~)) 603 of the *State Plumbing Code*.

M2101.4 Pipe penetrations. Openings through concrete or masonry building elements shall be sleeved.

M2101.5 Contact with building material. A hydronic piping system shall not be in direct contact with any building material that causes the piping material to degrade or corrode.

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load-bearing members of cold-formed steel *light-frame construction* shall be permitted only in accordance with Sections R505.2.6, R603.2.6 and R804.2.6. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.3, cutting and notching of flanges and lips of load-bearing members of cold-formed steel *light-frame construction* shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R610.7.

[W] ((~~M2101.7 Prohibited tee applications.~~ ~~Fluid in the supply side of a hydronic system shall not enter a tee fitting through the branch opening.~~))

M2101.8 Expansion, contraction and settlement. Piping shall be installed so that piping, connections and *equipment* shall not be subjected to excessive strains or stresses. Provisions shall be made to compensate for expansion, contraction, shrinkage and structural settlement.

M2101.9 Piping support. Hangers and supports shall be of material of sufficient strength to support the piping, and shall be fabricated from materials compatible with the piping material. Piping shall be supported at intervals not exceeding the spacing specified in Table M2101.9.

TABLE M2101.9
HANGER SPACING INTERVALS

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
ABS	4	10[a]
CPVC ≤ 1-inch pipe or tubing	3	5[a]
CPVC ≥ 1-1/4 inches	4	10[a]
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing	6	10
PB pipe or tubing	2.67	4
PE pipe or tubing	2.67	4
PE-RT ≤ 1 inch	2.67	10[a]
PE-RT ≥ 1-1/4 inches	4	10[a]

M2101.25 Protection of potable water. Where hydronic systems have a connection to a potable water supply, the potable water system shall be protected from backflow in accordance with Section P2902.

M2101.26 Pipe penetrations. Openings for pipe penetrations in walls, floors and ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with Section P2606.1.

M2101.27 Clearance from combustibles. A pipe in a piping system having an exterior surface temperature exceeding 250ºF (121ºC) shall have a clearance of not less than 1 inch (25 mm) from *combustible materials*.

M2101.28 Contact with building material. A piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interfere with the operation of the system.

M2101.29 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

M2101.29.1 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

M2101.30 Chemical compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings and mechanical systems.

M2101.31 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

SECTION M2102
BASEBOARD CONVECTORS

M2102.1 General. Baseboard convectors shall be installed in accordance with the manufacturer's instructions. Convectors shall be supported independently of the hydronic piping.

SECTION M2103
FLOOR HEATING SYSTEMS

M2103.1 Piping materials. Piping for embedment in concrete or gypsum materials shall be standard-weight steel pipe, copper and copper-alloy pipe and tubing, cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe, chlorinated polyvinyl chloride (CPVC), cross-linked polyethylene (PEX) tubing, polyethylene of raised temperature (PE-RT) or polypropylene (PP) with a rating of not less than 80 pounds per square inch at 180°F (552 kPa at 82°C).

M2103.2 Thermal barrier required. Radiant floor heating systems shall have a thermal barrier in accordance with Sections M2103.2.1 and M2103.2.2. Insulation *R*-values for slab-on-grade and suspended floor installations shall be in accordance with Chapter 11.

Exception: Insulation shall not be required in engineered systems where it can be demonstrated that the insulation will decrease the efficiency or have a negative effect on the installation.

M2103.2.1 Thermal break required. A thermal break consisting of asphalt expansion joint materials or similar insulating materials shall be provided at a point where a heated slab meets a foundation wall or other conductive slab.

M2103.2.2 Thermal barrier material marking. Insulating materials used in thermal barriers shall be installed so that the manufacturer's *R*-value mark is readily observable upon inspection.

[W] M2103.3 Piping joints. Copper and copper-alloy systems shall be soldered ((~~, brazed, or press connected~~)) in accordance with ASTM B828. ((~~Soldering shall be in accordance with ASTM B828.~~)) Fluxes for soldering shall be in accordance with ASTM B813. Brazing fluxes shall be in accordance with AWS A5.31. ((~~Press-connect joints shall be in accordance with ASME B16.51.~~)) Piping joints that are embedded shall be installed in accordance with the following requirements:

1. Steel pipe joints shall be welded.
2. Copper tubing shall be joined by brazing complying with Section ((~~P3003.6.1~~)) 605 of the *State Plumbing Code*.
3. Polybutylene pipe and tubing joints shall be installed with socket-type heat-fused polybutylene fittings.
4. CPVC tubing shall be joined using solvent cement joints.
5. Polypropylene pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings.
6. Cross-linked polyethylene (PEX) tubing shall be joined using cold expansion, insert or compression fittings.
7. Raised temperature polyethylene (PE-RT) tubing shall be joined using insert or compression fittings.

M2103.4 Testing. Piping or tubing to be embedded shall be tested by applying a hydrostatic pressure of not less than 100 psi (690 kPa). The pressure shall be maintained for 30 minutes, during which the joints shall be visually inspected for leaks.

TABLE M2105.4
GROUND-SOURCE LOOP PIPE

MATERIAL	STANDARD
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F437; ASTM F438; ASTM F439; ASTM F441; ASTM F442; CSA B137.6
Cross-linked polyethylene (PEX)	ASTM F876; CSA B137.5; ANSI/CSA/IGSHPA C448; NSF 358-3
High-density polyethylene (HDPE)	ASTM D2737; ASTM D3035; ASTM F714; AWWA C901; CSA B137.1; ANSI/CSA/IGSHPA C448; NSF 358-1
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; AWWA C903; CSA B137.9
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
Polyvinyl chloride (PVC)	ASTM D1785; ASTM D2241; CSA B137.3
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18; ANSI/CSA/IGSHPA C448; NSF 358-4

M2105.5 Fittings. Ground-source heat-pump pipe fittings shall be *approved* for installation with the piping materials to be installed, shall conform to the standards listed in Table M2105.5 and, where installed underground, shall be suitable for burial.

TABLE M2105.5
GROUND-SOURCE LOOP PIPE FITTINGS

PIPE MATERIAL	STANDARD
Chlorinated polyvinyl chloride (CPVC)	ASTM D2846; ASTM F437; ASTM F438; ASTM F439; ASTM F1970; CSA B137.6
Cross-linked polyethylene (PEX)	ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F2434; CSA B137.5; ANSI/CSA/IGSHPA C448; NSF 358-3
High-density polyethylene (HDPE)	ASTM D2683; ASTM D3261; ASTM F1055; CSA B137.1; ANSI/CSA/IGSHPA C448; NSF 358-1
Polyethylene/aluminum/polyethylene (PE-AL-PE)	ASTM F1282; ASTM F2434; CSA B137.9
Polypropylene (PP-R)	ASTM F2389; CSA B137.11; NSF 358-2
Polyvinyl chloride (PVC)	ASTM D2464; ASTM D2466; ASTM D2467; ASTM F1970; CSA B137.2; CSA B137.3
Raised temperature polyethylene (PE-RT)	ASTM D2683; ASTM D3261; ASTM F1055; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; CSA B137.1; CSA B137.18; ANSI/CSA/IGSHPA C448; NSF 358-4

M2105.6 Joints and connections. Joints and connections shall be of an *approved* type. Joints and connections shall be tight for the pressure of the ground-source loop system. Joints used underground shall be *approved* for such applications.

M2105.6.1 Joints between different piping materials. Joints between different piping materials shall be made with *approved* transition fittings.

M2105.7 Preparation of pipe ends. Pipe shall be cut square and shall be free of burrs and obstructions. Pipe ends shall have full-bore openings and shall be prepared in accordance with the pipe manufacturer's instructions.

M2105.8 Joint preparation and installation. Where required by Sections M2105.9 through M2105.11, the preparation and installation of mechanical and thermoplastic-welded joints shall comply with Sections M2105.8.1 and M2105.8.2.

M2105.8.1 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

M2105.8.2 Thermoplastic-welded joints. Joint surfaces for thermoplastic-welded joints shall be cleaned by an *approved* procedure. Joints shall be welded in accordance with the manufacturer's instructions.

[W] M2105.9 CPVC plastic pipe. Joints between CPVC plastic pipe or fittings shall be solvent-cemented in accordance with Section ((~~P2906.9.1.2~~)) 605 of the *State Plumbing Code*. Threaded joints between fittings and CPVC plastic pipe shall be in accordance with Section M2105.9.1.

M2105.9.1 Threaded joints. Threads shall conform to ASME B1.20.1. The pipe shall be Schedule 80 or heavier plastic pipe and shall be threaded with dies specifically designed for plastic pipe. Thread lubricant, pipe-joint compound or tape shall be applied on the male threads only and shall be *approved* for application on the piping material.

M2105.10 Cross-linked polyethylene (PEX) plastic tubing. Joints between cross-linked polyethylene plastic tubing and fittings shall comply with Sections M2105.10.1 and M2105.10.2. Mechanical joints shall comply with Section M2105.8.1.

M2105.10.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

M2105.10.2 Plastic-to-metal connections. Solder joints in a metal pipe shall not occur within 18 inches (457 mm) of a transition from such metal pipe to plastic pipe or tubing.

M2105.11 Polyethylene plastic pipe and tubing. Joints between polyethylene plastic pipe and tubing or fittings for ground-source heat-pump loop systems shall be heat-fusion joints complying with Section M2105.11.1, electrofusion joints complying with Section M2105.11.2, or stab-type insertion joints complying with Section M2105.11.3.

M2105.11.1 Heat-fusion joints. Joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, and joined in accordance with ASTM D2657. Joint surfaces shall be clean and free from moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall remain undisturbed until cool. Fittings shall be manufactured in accordance with ASTM D2683 or ASTM D3261.

M2105.11.2 Electrofusion joints. Joints shall be of the electrofusion type. Joint surfaces shall be clean and free from moisture, and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer. The joint shall remain undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F1055.

M2105.11.3 Stab-type insert fittings. Joint surfaces shall be clean and free from moisture. Pipe ends shall be chamfered and inserted into the fittings to full depth. Fittings shall be manufactured in accordance with ASTM F1924.

M2105.12 Polypropylene (PP) plastic. Joints between PP plastic pipe and fittings shall comply with Sections M2105.12.1 and M2105.12.2.

M2105.12.1 Heat-fusion joints. Heat-fusion joints for polypropylene (PP) pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings, electrofusion polypropylene fittings or by butt fusion. Joint surfaces shall be clean and free from moisture. The joint shall remain undisturbed until cool. Joints shall be made in accordance with ASTM F2389.

M2105.12.2 Mechanical and compression sleeve joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer's instructions.

M2105.13 Raised temperature polyethylene (PE-RT) plastic tubing. Joints between raised temperature polyethylene tubing and fittings shall comply with Sections M2105.13.1 through M2105.13.4. Mechanical joints shall comply with Section M2105.8.1.

M2105.13.1 Compression-type fittings. Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

M2105.13.2 PE-RT-to-metal connections. Solder joints in a metal pipe shall not occur within 18 inches (457 mm) of a transition from such metal pipe to PE-RT pipe or tubing.

M2105.13.3 Heat-fusion joints. Heat-fusion joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, and shall be joined in accordance with ASTM D2657. Joint surfaces shall be clean and free from moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall remain undisturbed until cool. Fittings shall be manufactured in accordance with ASTM D2683 or ASTM D3261.

M2105.13.4 Electrofusion joints. Joints shall be of the electrofusion type. Joint surfaces shall be clean and free from moisture and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer and joined. The joint shall remain undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F1055.

[W] M2105.14 PVC plastic pipe. Joints between PVC plastic pipe or fittings shall be solvent-cemented in accordance with Section ((~~P2906.9.1.4~~)) 605 of the *State Plumbing Code*. Threaded joints between fittings and PVC plastic pipe shall be in accordance with Section M2105.9.1.

M2105.15 Shutoff valves. Shutoff valves shall be installed in ground-source loop piping systems in the locations indicated in Sections M2105.15.1 through M2105.15.6.

M2105.15.1 Heat exchangers. Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shutoff valves shall not be required where heat exchangers are integral with a boiler or are a component of a manufacturer's boiler and heat exchanger packaged unit and are capable of being isolated from the hydronic system by the supply and return valves required by Section M2001.3.

M2105.15.2 Central systems. Shutoff valves shall be installed on the building supply and return of a central utility system.

M2105.15.3 Pressure vessels. Shutoff valves shall be installed on the connection to any pressure vessel.

M2105.15.4 Pressure-reducing valves. Shutoff valves shall be installed on both sides of a pressure-reducing valve.

M2105.15.5 Equipment and appliances. Shutoff valves shall be installed on connections to mechanical equipment and *appliances*. This requirement does not apply to components of ground-source loop systems such as pumps, air separators, metering devices, and similar equipment.

M2105.15.6 Expansion tanks. Shutoff valves shall be installed at connections to nondiaphragm-type expansion tanks.

M2105.16 Reduced pressure. A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section M2002.

M2105.17 Installation. Piping, valves, fittings, and connections shall be installed in accordance with the manufacturer's instructions.

[W] M2105.18 Protection of potable water. Where ground-source heat-pump ground-loop systems have a connection to a potable water supply, the potable water system shall be protected from backflow in accordance with Section ((~~P2902~~)) 603 of the *State Plumbing Code*.

[W] M2105.19 Pipe penetrations. Openings for pipe penetrations in walls, floors and ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with Section ((~~P2606.1~~)) 312 of the *State Plumbing Code*.

M2105.20 Clearance from combustibles. A pipe in a ground-source heat pump piping system having an exterior surface temperature exceeding 250°F (121°C) shall have a clearance of not less than 1 inch (25 mm) from *combustible materials*.

M2105.21 Contact with building material. A ground-source heat-pump ground-loop piping system shall not be in direct contact with building materials that cause the piping or fitting material to degrade or corrode, or that interfere with the operation of the system.

M2105.22 Strains and stresses. Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

M2105.22.1 Flood hazard. Piping located in a flood hazard area shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the *design flood elevation*.

M2105.23 Pipe support. Pipe shall be supported in accordance with Section M2101.9.

M2105.24 Velocities. Ground-source heat-pump ground-loop systems shall be designed so that the flow velocities do not exceed the maximum flow velocity recommended by the pipe and fittings manufacturer. Flow velocities shall be controlled to reduce the possibility of water hammer.

M2105.25 Labeling and marking. Ground-source heat-pump ground-loop system piping shall be marked with tape, metal tags or other methods where it enters a building. The marking shall state the following words: "GROUND-SOURCE HEAT-PUMP LOOP SYSTEM." The marking shall indicate if antifreeze is used in the system and shall indicate the chemicals by name and concentration.

M2105.26 Chemical compatibility. Antifreeze and other materials used in the system shall be chemically compatible with the pipe, tubing, fittings and mechanical systems.

M2105.27 Makeup water. The transfer fluid shall be compatible with the makeup water supplied to the system.

M2105.28 Testing. Before connection header trenches are backfilled, the assembled loop system shall be pressure tested with water at 100 psi (689 kPa) for 15 minutes without observed leaks. Flow and pressure loss testing shall be performed and the actual flow rates and pressure drops shall be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10 percent, the cause shall be identified and corrective action taken.

M2105.29 Embedded piping. Ground-source heat-pump ground-loop piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

CHAPTER 23
SOLAR THERMAL ENERGY SYSTEMS

User notes:

About this chapter: *Chapter 23 is specific to thermal solar systems and equipment. Solar voltaic systems are not addressed in this chapter. This chapter covers solar collectors, system design, safety devices, relief valves, freeze protection, expansion tanks, signage, labeling, heat transfer fluids, protection of potable water and potable water heating.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Plumbing/Mechanical Code Development Committee during the 2021 (Group A) Code Development Cycle.*

SECTION M2301
SOLAR THERMAL ENERGY SYSTEMS

M2301.1 General. This section provides for the design, construction, installation, *alteration* and *repair* of equipment and systems using solar thermal energy to provide space heating or cooling, hot water heating and swimming pool heating.

M2301.2 Design and installation. The design and installation of solar thermal energy systems shall comply with Sections M2301.2.1 through M2301.2.13.

M2301.2.1 Access. Access shall be provided to solar energy equipment for maintenance. Solar systems and appurtenances shall not obstruct or interfere with the operation of any doors, windows or other building components requiring operation or access. Roof-mounted solar thermal equipment shall not obstruct or interfere with the operation of roof-mounted equipment, *appliances*, chimneys, plumbing vents, roof hatches, smoke vents, skylights and other roof penetrations and openings.

M2301.2.2 Collectors and panels. Solar collectors and panels shall comply with Sections M2301.2.2.1 and M2301.2.2.2.

M2301.2.2.1 Roof-mounted collectors. The roof shall be constructed to support the loads imposed by roof-mounted solar collectors. Roof-mounted solar collectors that serve as a roof covering shall conform to the requirements for roof coverings in Chapter 9 of this code. Where mounted on or above the roof coverings, the collectors and supporting structure shall be constructed of *noncombustible materials* or fire-retardant-treated wood equivalent to that required for the roof construction.

M2301.2.2.2 Collector sensors. Collector sensor installation, sensor location and the protection of exposed sensor wires from degradation shall be in accordance with ICC 900/SRCC 300.

[W] M2301.2.3 Pressure and temperature relief valves and system components. System components containing fluids shall be protected with temperature and pressure relief valves or pressure relief valves. Relief devices shall be installed in sections of the system so that a section cannot be valved off or isolated from a relief device. Direct systems and the potable water portion of indirect systems shall be equipped with a relief valve in accordance with Section ((~~P2804~~)) 504 of the *State Plumbing Code*. For indirect systems, pressure relief valves in solar loops shall comply with ((~~ICC 900/~~)) SRCC 300. System components shall have a working pressure rating of not less than the setting of the pressure relief device.

M2301.2.4 Vacuum relief. System components that might be subjected to a vacuum during operation or shutdown shall be designed to withstand such a vacuum or shall be protected with vacuum relief valves.

[W][S] M2301.2.5 Piping insulation. Piping shall be insulated in accordance with the requirements of ((~~Chapter 11~~)) the residential portion of the *Seattle Energy Code*. Exterior insulation shall be protected from ultraviolet degradation. The entire solar loop shall be insulated. Where split-style insulation is used, the seam shall be sealed. Fittings shall be fully insulated.

((~~**Exceptions:**~~

1. ~~Those portions of the piping that are used to help prevent the system from overheating shall not be required to be insulated.~~
2. ~~Those portions of piping that are exposed to solar radiation, made of the same material as the solar collector absorber plate and are covered in the same manner as the solar collector absorber, or that are used to collect additional solar energy, shall not be required to be insulated.~~
3. ~~Piping in thermal solar systems using unglazed solar collectors to heat a swimming pool shall not be required to be insulated.~~))

M2301.2.6 Protection from freezing. System components shall be protected from damage resulting from freezing of heat-transfer liquids at the winter design temperature provided in Table R301.2. Freeze protection shall be provided in accor-

dance with ICC 900/SRCC 300. Drain-back systems shall be installed in compliance with Section M2301.2.6.1. Systems utilizing freeze-protection valves shall comply with Section M2301.2.6.2.

Exception: Where the 97.5-percent winter design temperature is greater than or equal to 48°F (9°C).

M2301.2.6.1 Drain-back systems. Drain-back systems shall be designed and installed to allow for manual gravity draining of fluids from areas subject to freezing to locations not subject to freezing, and air filling of the components and piping. Such piping and components shall maintain a horizontal slope in the direction of flow of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope). Piping and components subject to manual gravity draining shall permit subsequent air filling upon drainage and air venting upon refilling.

M2301.2.6.2 Freeze-protection valves. Freeze-protection valves shall discharge in a manner that does not create a hazard or structural damage.

M2301.2.7 Storage tank sensors. Storage tank sensors shall comply with ICC 900/SRCC 300.

M2301.2.8 Expansion tanks. Expansion tanks in *solar energy systems* shall be installed in accordance with Section M2003 in solar collector loops that contain pressurized heat transfer fluid. Where expansion tanks are used, the system shall be designed in accordance with ICC 900/SRCC 300 to provide an expansion tank that is sized to withstand the maximum operating pressure of the system.

Exception: Expansion tanks shall not be required in the collector loop of *drain-back systems*.

M2301.2.9 Roof and wall penetrations. Roof and wall penetrations shall be flashed and sealed in accordance with Chapter 9 to prevent entry of water, rodents and insects.

M2301.2.10 Description and warning labels. Solar thermal systems shall comply with description *label* and warning *label* requirements of Section M2301.2.11.2 and ICC 900/SRCC 300.

M2301.2.11 Solar loop. Solar loops shall be in accordance with Sections M2301.2.11.1 and M2301.2.11.2.

M2301.2.11.1 Solar loop isolation. Valves shall be installed to allow the solar loop to be isolated from the remainder of the system.

M2301.2.11.2 Drain and fill valve labels and caps. Drain and fill valves shall be *labeled* with a description and warning that identifies the fluid in the solar loop and a warning that the fluid might be discharged at high temperature and pressure. Drain caps shall be installed at drain and fill valves.

M2301.2.12 Maximum temperature limitation. Systems shall be equipped with means to limit the maximum water temperature of the system fluid entering or exchanging heat with any pressurized vessel inside the *dwelling* to 180°F (82°C). This protection is in addition to the required temperature and pressure relief valves required by Section M2301.2.3.

M2301.2.13 Thermal storage unit seismic bracing. In Seismic Design Categories D_0, D_1 and D_2 and in townhouses in Seismic Design Category C, thermal storage units shall be anchored in accordance with Section M1307.2.

M2301.3 Labeling. *Labeling* shall comply with Sections M2301.3.1 and M2301.3.2.

M2301.3.1 Collectors and panels. Solar thermal collectors and panels shall be *listed* and *labeled* in accordance with ICC 901/SRCC 100. Factory-built collectors shall bear a *label* indicating the manufacturer's name, model number and serial number.

M2301.3.2 Thermal storage units. Pressurized water storage tanks shall bear a *label* indicating the manufacturer's name and address, model number, serial number, storage unit maximum and minimum allowable operating temperatures and storage unit maximum and minimum allowable operating pressures. The *label* shall clarify that these specifications apply only to the water storage tanks.

[W] M2301.4 Heat transfer gases or liquids and heat exchangers. *Essentially toxic transfer* ((~~*fluids*~~)) *liquids*, ethylene glycol, flammable gases and flammable liquids shall not be used as heat transfer fluids. Heat transfer gases and liquids shall be rated to withstand the system's maximum design temperature under operating conditions without degradation. Heat exchangers used in solar thermal systems shall comply with Section ((~~P2902.5.2~~)) 603.5.4 of the *State Plumbing Code* and ((~~ICC 900/~~)) SRCC 300.

Heat transfer fluids shall be in accordance with ((~~ICC 900/~~)) SRCC 300. The flash point of the heat transfer fluids utilized in solar thermal systems shall be not less than 50 ((°)) degrees F (((~~28°C~~))) above the design maximum nonoperating or no-flow temperature attained by the fluid in the collector.

[S] M2301.5 Backflow protection. Connections from the potable water supply to solar systems shall comply with ((~~Section P2902.5.5~~)) the *Uniform Plumbing Code*.

M2301.6 Filtering. Air provided to *occupied spaces* that passes through thermal mass storage systems by mechanical means shall be filtered for particulates at the outlet of the thermal mass storage system.

[W] M2301.7 Solar thermal systems for heating potable water. Where a solar thermal system heats potable water to supply a potable hot water distribution system, the solar thermal system shall be in accordance with Sections M2301.7.1, M2301.7.2 and ((~~P2902.5.5~~)) the *State Plumbing Code*.

M2301.7.1 Indirect systems. Heat exchangers that are components of indirect solar thermal heating systems shall comply with ((~~Section P2902.5.2~~)) the *State Plumbing Code*.

M2301.7.2 Direct systems. Where potable water is directly heated by a solar thermal system, the pipe, fittings, valves and other components that are in contact with the potable water in the solar heating system shall comply with the requirements of Chapter ((~~29~~)) 6 of the *State Plumbing Code*.

VENTED WALL FURNACE. A self-contained vented *appliance* complete with grilles or equivalent, designed for incorporation in or permanent attachment to the structure of a building, mobile home or travel trailer, and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing. This definition shall exclude *floor furnaces, unit heaters* and *central furnaces* as herein defined.

VENTING SYSTEM. A continuous open passageway from the *flue collar* or *draft hood* of an *appliance* to the outdoor atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and *vent connector*, if used, assembled to form the open passageway.

WALL HEATER, UNVENTED TYPE. A room heater of the type designed for insertion in or attachment to a wall or partition. Such heater does not incorporate concealed venting arrangements in its construction and discharges all products of *combustion* through the front into the room being heated.

WATER HEATER. Any heating *appliance* or *equipment* that heats potable water and supplies such water to the potable hot water distribution system.

SECTION G2404 (301)
GENERAL

G2404.1 (301.1) Scope. This section shall govern the approval and installation of all *equipment* and *appliances* that comprise parts of the installations regulated by this code in accordance with Section G2401.

G2404.2 (301.1.1) Other fuels. The requirements for *combustion* and *dilution air* for gas-fired *appliances* shall be governed by Section G2407. The requirements for *combustion* and *dilution air* for *appliances* operating with fuels other than fuel gas shall be regulated by Chapter 17.

G2404.3 (301.3) Listed and labeled. *Appliances* regulated by this code shall be *listed* and *labeled* for the application in which they are used unless otherwise *approved* in accordance with Section ((~~R104.11~~)) R104.6. The approval of unlisted *appliances* in accordance with Section ((~~R104.11~~)) R104.6 shall be based on *approved* engineering evaluation.

G2404.4 (301.8) Vibration isolation. Where means for isolation of vibration of an *appliance* is installed, an *approved* means for support and restraint of that *appliance* shall be provided.

G2404.5 (301.9) Repair. Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

G2404.6 (301.10) Wind resistance. *Appliances* and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with this code.

G2404.7 (301.11) Flood hazard. For structures located in flood hazard areas, the *appliance*, equipment and system installations regulated by this code shall be located at or above the elevation required by Section R322 for utilities and attendant equipment.

Exception: The *appliance*, equipment and system installations regulated by this code are permitted to be located below the elevation required by Section R322 for utilities and attendant equipment provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to such elevation.

G2404.8 (301.12) Seismic resistance. Where earthquake loads are applicable in accordance with this code, the supports shall be designed and installed for the seismic forces in accordance with this code.

G2404.9 (301.14) Rodentproofing. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entry of rodents.

G2404.10 (307.5) Auxiliary drain pan. Category IV condensing *appliances* shall be provided with an auxiliary drain pan where damage to any building component will occur as a result of stoppage in the *condensate* drainage system. Such pan shall be installed in accordance with the applicable provisions of Section M1411.

Exception: An auxiliary drain pan shall not be required for *appliances* that automatically shut down operation in the event of a stoppage in the *condensate* drainage system.

G2404.11 (307.6) Condensate pumps. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the *appliance* or *equipment* served such that when the pump fails, the *appliance* or *equipment* will be prevented from operating. Pumps shall be installed in accordance with the manufacturer's instructions.

temperature recommendations; used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion and contraction; and shall be *approved*.

5. Where pipe fittings are drilled and tapped in the field, the operation shall be in accordance with all of the following:
   5.1. The operation shall be performed on systems having operating pressures of 5 psi (34.5 kPa) or less.
   5.2. The operation shall be performed by the gas supplier or the gas supplier's designated representative.
   5.3. The drilling and tapping operation shall be performed in accordance with written procedures prepared by the gas supplier.
   5.4. The fittings shall be located outdoors.
   5.5. The tapped fitting assembly shall be inspected and proven to be free of leakage.

G2414.10 (403.10) Plastic piping, joints and fittings. Plastic *pipe, tubing* and fittings shall be joined in accordance with the manufacturers' instructions. Such joints shall comply with the following:

1. The joints shall be designed and installed so that the longitudinal pull-out resistance of the joint will be greater than or equal to the tensile strength of the plastic *piping* material.
2. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gastight joints as strong as or stronger than the *pipe* or *tubing* being joined. Joints shall be made with the joining method recommended by the *pipe* manufacturer. Polyethylene heat fusion fittings shall be marked "ASTM D2513." Polyamide heat fusion fittings shall be marked "ASTM F2945."
3. Where compression-type *mechanical joints* are used, the gasket material in the fitting shall be compatible with the plastic *piping* and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the *pipe* or *tubing* and shall extend to or beyond the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force-fit in the plastic. Split tubular stiffeners shall not be used.
4. Plastic *piping* joints and fittings for use in *liquefied petroleum gas piping systems* shall be in accordance with NFPA 58.

SECTION G2415 (404)
PIPING SYSTEM INSTALLATION

G2415.1 (404.1) Installation of materials. Materials used shall be installed in strict accordance with the standards under which the materials are accepted and *approved*. In the absence of such installation procedures, the manufacturer's instructions shall be followed. Where the requirements of referenced standards or manufacturer's instructions do not conform to minimum provisions of this code, the provisions of this code shall apply.

G2415.2 (404.2) CSST. CSST piping systems shall be installed in accordance with the terms of their approval, the conditions of listing, the manufacturer's instructions and this code.

G2415.3 (404.3) Prohibited locations. *Piping* shall not be installed in or through a ducted supply, return or exhaust, or a clothes chute, *chimney* or gas vent, dumbwaiter or elevator shaft. *Piping* installed downstream of the *point of delivery* shall not extend through any townhouse unit other than the unit served by such *piping*.

G2415.4 (404.4) Piping in solid partitions and walls. *Concealed piping* shall not be located in solid partitions and solid walls, unless installed in a chase or casing.

G2415.5 (404.5) Fittings in concealed locations. Fittings installed in concealed locations shall be limited to the following types:

1. Threaded elbows, tees, couplings, plugs and caps.
2. Brazed fittings.
3. Welded fittings.
4. Fittings *listed* to ANSI LC1/CSA 6.26 or ANSI LC4/CSA 6.32.

Informational Note: Threaded plugs and caps are not permitted in concealed locations in accordance with Section 404.5 of the Seattle Fuel Gas Code.

G2415.6 (404.6) Underground penetrations prohibited. Gas *piping* shall not penetrate building foundation walls at any point below grade. Gas *piping* shall enter and exit a building at a point above grade and the annular space between the *pipe* and the wall shall be sealed.

Part VII—Plumbing

CHAPTERS 25 through 28

Note: Chapters 25 through 28 are not adopted in The City of Seattle. See the *Uniform Plumbing Code*.

CHAPTER 29

WATER SUPPLY AND DISTRIBUTION

User notes:

About this chapter: *Many plumbing fixtures require a supply of potable water. Other fixtures could be supplied with nonpotable water such as reclaimed water. Chapter 29 covers the requirements for water distribution piping systems to and within buildings. The regulations include the types of materials and the connection methods for such systems. This chapter regulates the assemblies, devices and methods that are used for the prevention of backflow of contaminated or polluted water into the potable water system. Also contained in this chapter are the design requirements for the installation of fire sprinkler systems, as such systems are connected to the potable water supply for the building. Storm water and some liquid waste from a building can be a source of nonpotable water that can used to reduce the volume of potable water supplied to the building. This chapter provides the requirements for storage, treatment and distribution of this resource. This chapter also regulates the piping systems for reclaimed water supplied by a wastewater treatment facility.*

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*

Note: Sections of Chapter 29 not shown are not adopted by The City of Seattle.

SECTION P2901
GENERAL

P2901.1 Potable water required. Potable water shall be supplied to plumbing fixtures and plumbing *appliances* except where treated rainwater, treated graywater or municipal reclaimed water is supplied to water closets, urinals and trap primers. The requirements of this section shall not be construed to require signage for water closets and urinals.

P2901.2 Identification of nonpotable water systems. Where *nonpotable* water systems are installed, the piping conveying the nonpotable water shall be identified either by color marking, metal tags or tape in accordance with Sections P2901.2.1 through P2901.2.2.3.

P2901.2.1 Signage required. Nonpotable water outlets such as hose connections, open-ended pipes and faucets shall be identified with signage that reads as follows: "Nonpotable water is utilized for [application name]. CAUTION: NONPOTABLE WATER. DO NOT DRINK." The words shall be legibly and indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 0.5 inches (12.7 mm) in height and in colors in contrast to the background on which they are applied. In addition to the required wordage, the pictograph shown in Figure P2901.2.1 shall appear on the required signage.

FIGURE P2901.2.1
PICTOGRAPH—DO NOT DRINK

P2901.2.2 Distribution pipe labeling and marking. Nonpotable distribution piping shall be: purple in color and embossed or integrally stamped or marked with the words, "CAUTION: NONPOTABLE WATER. DO NOT DRINK"; or installed with a purple identification tape or wrap. Pipe identification shall include the contents of the piping system and an arrow indicating the direction of flow. Hazardous piping systems shall contain information addressing the nature of the hazard. Pipe identification shall be repeated at intervals not exceeding 25 feet (7620 mm) and at each point where the piping passes through a wall, floor or roof. Lettering shall be readily observable within the room or space where the piping is located.

Exception: Installation of freezeproof yard hydrants that drain the riser into the ground shall be permitted if the potable water supply to such hydrants is protected upstream of the hydrants in accordance with Section P2902 and the hydrants are permanently identified as nonpotable outlets by *approved* signage that reads, "CAUTION, NONPOTABLE WATER. DO NOT DRINK."

P2903.10 Hose bibb. Hose bibbs subject to freezing, including the "frostproof" type, shall be equipped with an accessible stop-and-waste-type valve inside the building so that they can be controlled and drained during cold periods.

Exception: Frostproof hose bibbs installed such that the stem extends through the building insulation into an open heated or *semiconditioned space* need not be separately valved (see Figure P2903.10).

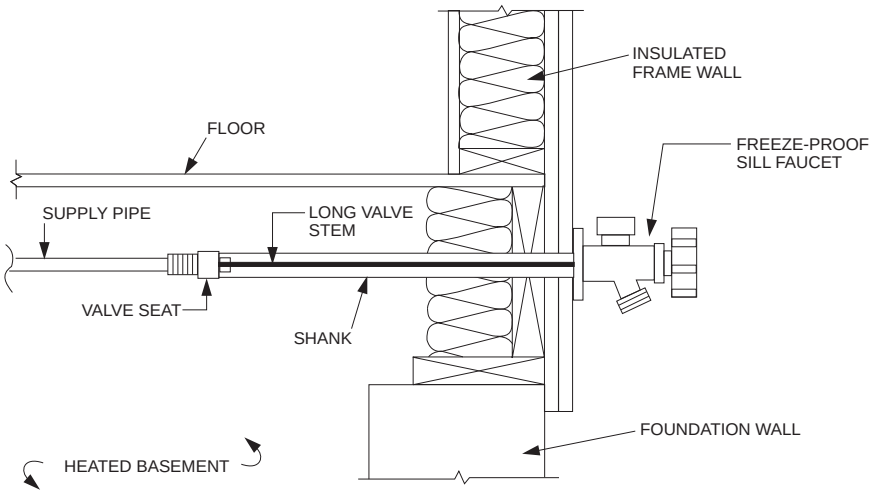


FIGURE P2903.10
TYPICAL FROSTPROOF HOSE BIBB INSTALLATION NOT REQUIRING SEPARATE VALVE

P2903.11 Drain water heat recovery units. Drain water heat recovery units shall be in accordance with Section N1103.5.4.

SECTION P2904
DWELLING UNIT FIRE SPRINKLER SYSTEMS

P2904.1 General. The design and installation of residential automatic sprinkler systems shall be in accordance with NFPA 13D or Section P2904, which shall be considered to be equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed only in buildings not required to be equipped with a residential sprinkler system. Section P2904 shall apply to stand-alone and multipurpose wet-pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall provide domestic water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the water distribution system. A backflow preventer shall not be required to separate a sprinkler system from the water distribution system, provided that the sprinkler system complies with all of the following:

1. The system complies with NFPA 13D or Section P2904.
2. The piping material complies with Section P2906.
3. The system does not contain antifreeze.
4. The system does not have a fire department connection.

[W] P2904.1.1 Required sprinkler locations. Sprinklers shall be installed to protect all areas of a *dwelling unit*.

Exceptions:

1. ((~~*Attics*~~)) Uninhabitable attics, crawl spaces and normally unoccupied concealed spaces that do not contain fuel-fired *appliances* do not require sprinklers. In uninhabitable *attics*, crawl spaces and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be installed above the equipment; however, sprinklers shall not be required in the remainder of the space.
2. Clothes closets, linen closets and pantries not exceeding 24 square feet (2.2 m^2) in area, with the smallest dimension not greater than 3 feet (915 mm) and having wall and ceiling surfaces of gypsum board.

((~~3. Bathrooms not more than 55 square feet (5.1 m^2) in area.~~

~~4. Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.~~))

CHAPTERS 30 through 43

Note: Chapters 30 through 43 are not adopted in The City of Seattle.

[W] CHAPTER 44
EXISTING BUILDINGS AND STRUCTURES

SECTION 4401
SCOPE

R4401.1 General. *Repairs*, *alterations*, *additions*, and relocation of existing buildings and structures shall comply with the provisions of this code for new construction, except as modified by this chapter. Structural elements and systems shall comply with Section R107.4 and the provisions of this chapter.

SECTION R4402
COMPLIANCE

R4402.1 General. The work shall not cause the building or structure to become unsafe or adversely affect the performance of the building; shall not cause an existing mechanical or plumbing system to become unsafe, hazardous, insanitary or overloaded; and unless expressly permitted by these provisions, shall not make the building any less compliant with this code or to any previously approved alternative arrangements than it was before the work was undertaken.

R4402.2 Structural. Structural elements and systems that are altered, repaired, or replaced shall comply with the structural provisions of this chapter and of Chapter 3 through Chapter 10 of the *International Residential Code* unless noted otherwise.

R4402.2.1 Unreinforced masonry parapet bracing. Unreinforced masonry buildings located in Seismic Design Category D0, D1, D2, shall have parapet bracing and wall anchors installed at the roofline whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be of an approved design unless an evaluation demonstrates compliance of the existing bracing and anchorage.

R4402.3 Smoke alarms. Smoke alarms shall be provided in accordance with Section R314.2.2.

R4402.4 Carbon monoxide alarms. Carbon monoxide alarms shall be provided in accordance with Section R315.2.2.

R4402.5 Replacement windows. Where an existing window, including the sash and glazed portion, or safety glazing is replaced, the replacement window or safety glazing shall comply with the requirements of Sections R4402.5.1 through R4402.5.4 as applicable.

R4402.5.1 Energy efficiency. Replacement windows shall comply with the requirements of the Washington State Residential Energy Code.

R4402.5.2 Safety glazing. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.

R4402.5.3 Window fall protection. Window fall protection shall be installed in accordance with R312.2.

Exception: Where only the window glazing is being replaced.

R4402.5.4 Replacement windows for emergency escape and rescue openings. Replacement windows shall be exempt from Sections R310.2 and R310.4.4, provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window is of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement window is not part of a change of use.

R4402.5.5 Window opening control device and fall protection device height. Window opening control devices or fall protection devices shall be located at a height per R310.1.1 or at as low a height as can be installed within the existing clear opening.

R4402.6 Flood hazard areas. Work performed in existing buildings located in a flood hazard area as established by Table R301.2(1) shall be subject to the provisions of Section 105.7.3.

SECTION R4403
REPAIRS

R4403.1 General. *Repairs* shall comply with the applicable provisions of this code for new construction or as permitted by this section. Work on undamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to requirements for *alterations*.

R4403.2 Materials. Materials used during *repairs* shall comply with this section.

R4403.2.1 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by this code for new construction shall be used. Like materials shall be permitted for *repairs*, provided that *unsafe* conditions are not created. Hazardous materials shall not be used where this code does not permit their use in buildings of similar occupancy, purpose, and location.

R4403.2.2 Existing materials. Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building official to be *unsafe*.

R4403.2.3 Plumbing materials and supplies. The following plumbing materials and supplies shall not be used:

1. All-purpose solvent cement, unless *listed* for the specific application.
2. Flexible traps and tailpieces, unless *listed* for the specific application.
3. Solder having more than 0.2-percent lead in the repair of potable water systems.

R4403.3 Water closets. Where any water closet is replaced with a newly manufactured water closet, the replacement water closet shall comply with the requirements of Uniform Plumbing Code Section 411.

R4403.4 Structural. Repaired structural elements and systems shall comply with Section 107.4 and the structural provisions of this chapter.

R4403.5 Demolition and replacement. Where a building or structure is effectively demolished by damage or where the intended method of repair is demolition and replacement, the replaced in the *International Residential Code*.

Exception: Existing foundations are permitted to remain and be reused where approved by the code official.

SECTION R4404
ALTERATIONS

R4404.1 General. *Alterations* to existing buildings shall comply with the provisions of this code for new construction, except as permitted by this section.

R4404.2 Newly constructed elements. Newly constructed elements, components and systems shall comply with the requirements of this code.

Exception: Added openable windows are not required to comply with the light and ventilation requirements of Section R303.

R4404.3 Nonconformities. The work shall not increase the extent of noncompliance or create nonconformity to those requirements that did not previously exist.

R4404.4 Structural. Altered structural elements and systems shall comply with Section 107.4 and the structural provisions of this Chapter. New elements shall meet all of the requirements of this code for new construction. Structural elements that are uncovered during the course of the alteration and that are found to be unsafe shall be repaired in accordance with Section R107.4.

R4404.4.1 Decreased structural capacity. Where an *alteration* causes a decrease in capacity in any structural component, that structural component shall be shown to comply or shall be altered to comply with the applicable provisions of Chapters 3, 4, 5, 6, and 8.

R4404.4.2 Increased design loads. Where an *alteration* causes an increase in loads as described in this section, the existing structural components that support the increased load, including the foundation, shall be shown to comply or shall be altered to comply with the applicable provisions of Chapters 3, 4, 5, 6, and 8. Existing structural components that do not provide support for the increased loads shall not be required to comply with this section.

R4404.4.2.1 Dead load increase. Dead load shall be considered to be increased for purposes of this section when the weight of materials used for the *alteration* exceeds the weight of the materials replaced, or when new materials or elements are added.

Exceptions:

1. Buildings in which the increase in dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m2) or less over an existing single layer of roof covering.
2. Installation of rooftop-mounted photovoltaic (PV) panel systems weighing 4 pounds per square foot or less over an existing single layer of roof covering.

R4404.4.2.2 Live load increase. An increase in live load shall be determined based on Table R301.5.

R4404.4.2.3 Snow load increase. Snow load shall be considered to be increased for purposes of this section when alteration of the roof configuration creates new areas that accumulate drifted snow.

R4404.4.2.4 Wind load increase. Wind load shall be considered to be increased for purposes of this section when the surface area of any exterior elevation subject to wind pressure is increased by more than 5%.

R4404.4.2.5 Seismic load increase. Seismic load shall be considered to be increased for purposes of this section in *existing buildings* assigned to Seismic Design Category C, D0, D1, or D2 where new materials replace lighter weight materials in one of the following conditions:

1. Concrete tile or tile roof covering of similar weight is installed on more than 50% of the total roof area.
2. Brick veneer or cladding of similar weight is installed on walls above the second story.

R4404.5 Ventilation. Reconfigured spaces intended for occupancy, and spaces converted to habitable or occupiable space in any work area shall be provided with *ventilation* in accordance with Section R303.

R4404.6 Ceiling height. Where a *habitable attic* or *habitable space* in a basement is created in an existing building, ceiling height shall not be less than 6 feet 8 inches (2032mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 4 inches (1931 mm).

Exceptions:

1. For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet (1524 mm) and not less than 50 percent of the required floor area shall have a ceiling height of not less than 6 feet 8 inches (2134 mm).
2. At beams, girders, ducts or other obstructions, the ceiling height shall be not less than 6 feet 4 inches (1931 mm) from the finished floor.

R4404.7 Stairways, handrails and guards. Stairs, handrails and guards shall comply with this section.

R4404.7.1 Stairway Illumination. Stairways within the work area shall be provided with illumination in accordance with Section R303.6.

R4404.7.2 Stair width. Existing stairs not otherwise being altered or modified shall be permitted to maintain their current clear width at, above and below existing *handrails*.

R4404.7.3 Stair headroom. Headroom height on existing stairs being altered or modified shall not be reduced below the existing *stairway* finished headroom. Existing stairs not otherwise being altered shall be permitted to maintain the current finished headroom.

R4404.7.4 Stair landing. Landings serving existing stairs being altered or modified shall not be reduced below the existing *stairway* landing depth and width. Existing stairs not otherwise being altered shall be permitted to maintain the current landing depth and width.

R4404.7.5 Stair treads and risers. An existing *stairway* shall not be required to comply with Section R311.7.5 where the existing space and construction does not allow a reduction in pitch or slope. Where risers are added to an existing stair, the tread and riser dimensions of the added risers shall match the existing stair.

R4404.7.6 Handrails and guards. Where a stair or any portion of a stair is reconstructed, a handrail and guard, where required, shall be provided in accordance with Section R311 and R312.

SECTION R4405
ADDITIONS

R4405.1 Additions to an existing building. *Additions* shall comply with this section and other applicable provisions of this code for new construction.

R4405.2 Structure for horizontal additions. Where an *addition* involves new construction next to and attached to an existing building and includes *alterations* to the existing building, the *addition* shall meet all the requirements of this code for new construction. *Alterations* to the existing building shall comply with the requirements governing *alterations* within this code. In wood light-frame additions, connection of the structural components shall be permitted to be provided using wall top plates and addition studs that abut the existing building. Wall top plates shall be lapped and spliced in accordance with Section R602.3.2. Abutting studs shall be fastened in accordance with Table R602.3(1).

Exception: The structural components of the *addition* shall be permitted to be connected to the existing building in accordance with accepted engineering practice.

R4405.3 Structure for vertical additions. Where an *addition* involves new construction that adds a story to any part of the existing building or vertically increases the height of any part of the existing building, the new construction and the existing building together shall meet all of the structural requirements of this code for new construction.

Exception: Where the new structure and the existing structure together are evaluated in accordance with accepted engineering practice and are shown to be sufficient to support the combined loads from the new structure and existing structure, no structural alterations are required.

SECTION R4406
RELOCATED BUILDINGS

R4406.2 Relocated buildings. Residential buildings or structures moved into or within the jurisdiction are not required to comply with the requirements of this code if the original use classification of the building or structure is not changed. Any repair, alteration or change of use undertaken within the relocated structure shall comply with the requirements of this code applicable to the work being performed.

Part IX—Referenced Standards

CHAPTER ((~~44~~)) 45

REFERENCED STANDARDS

User notes:

About this chapter: *The one- and two-family dwelling code contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials, products and methods of construction. Chapter ((~~44~~)) 45 contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section R102.4.

AAMA

American Architectural Manufacturers Association
1900 E. Golf Road, Suite 1250
Schaumburg, IL 60173

450—20: Performance Rating Method for Mulled Combination Assemblies, Composite Units, and Other Mulled Fenestration Systems
R609.8

506—16: Voluntary Specifications for Impact and Cycle Testing of Fenestration Products
R609.6.1

711—20: Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
R703.4

712—14: Voluntary Specification for Mechanically Attached Flexible Flashing
R703.4

714—19: Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal around Exterior Wall Openings in Buildings
R703.4

AAMA/NSA 2100—19: Specifications for Sunrooms
R301.2.1.1.1

AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specification for Windows, Doors, and Skylights
N1102.4.3, R308.6.9, R609.3

ACCA

Air Conditioning Contractors of America
1330 Braddock Place, Suite 350
Alexandria, VA 22314

ANSI/ACCA 1 Manual D—2016: Residential Duct Systems
Table R301.2(1), M1601.1, M1602.2

ANSI/ACCA 2 Manual J—2016: Residential Load Calculation
N1103.7, M1401.3

ANSI/ACCA 3 Manual S—2014: Residential Equipment Selection
N1103.7, M1401.3

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

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AHAM

Association of Home Appliance Manufacturers
111 19th St NW, #402
Washington, D.C. 20036

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Certified Range Hood Directory
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AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001

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AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004

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ANCE

Association of Standardization and Certification
Av. Lázaro Cárdenas No. 869
Fraccion 3
Col. Nva. Industrial Vallejo
Deleg. Gustavo A. Madero
Mexico, D.F.

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American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

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A108.4—09: Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive
R702.4.1

A108.5—20: Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-Portland Cement Mortar
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A108.6—99 (Reaffirmed 2019): Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
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A108.11—10: Interior Installation of Cementitious Backer Units
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G2448.1

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ASHRAE

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180 Technology Parkway NW
Peachtree Corners, GA 30092

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ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

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A112.1.3—2000 (R2019): Air Gap Fittings for Fixtures, Appliances and Appurtenances
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A112.4.3—1999(R2020): Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System
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A112.4.4—2017: Plastic Push-Fit Drain, Waste, and Vent (DWV) Fittings
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A112.4.14—2019/CSA B125.14—19: Manually Operated Valves for Use in Plumbing Systems
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A112.6.2—2017: Framing-affixed Supports for Off-the-floor Water Closets with Concealed Tanks
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A112.14.1—03(2017): Backwater Valves
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A112.18.1—2018/CSA B125.1—2018: Plumbing Supply Fittings
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A112.18.2—2020/CSA B125.2—2020: Plumbing Waste Fittings
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B137.2—17: Polyvinylchloride PVC Injection-moulded Gasketed Fittings for Pressure Applications
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B137.3—17: Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications
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B137.5—17: Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications
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B137.6—17: Chlorinated polyvinylchloride CPVC Pipe, Tubing and Fittings For Hot- and Cold-water Distribution Systems
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B137.10—17: Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PE-AL-PE) Composite Pressure Pipe Systems
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B181.2—18: Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) Drain, Waste and Vent Pipe and Pipe Fittings
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CSSB

Cedar Shake & Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

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DASMA

Door & Access Systems Manufacturers Association International
1300 Sumner Avenue
Cleveland, OH 44115-2851

105—2017: Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors
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DHA

Decorative Hardwoods Association (formerly HPVA)
42777 Trade West Drive
Sterling, Virginia 20166

ANSI/HPVA HP-1—2016: American National Standard for Hardwood and Decorative Plywood
R702.5

DOC

United States Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230

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DOTn

U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590

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G2414.5.1

FEMA

Federal Emergency Management Agency
500 C Street SW
Washington, DC 20472

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Headquarters Office
Norwood, MA 02062

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GA

Gypsum Association
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782

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HVI

Home Ventilating Institute
1740 Dell Range Blvd., Suite H, PMB 450
Cheyenne, WY 82009

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2075—2013: Gas and Vapor Detectors and Sensors—with revisions through December 2017
R314.7.4, R315.7.1, R315.7.4

2158A—2013: Outline of Investigation for Clothes Dryer Transition Duct—with revisions through April 2017
M1502.4.3, G2439.7.3

2200—2012: Stationary Engine Generator Assemblies—with revisions through October 2015
R329.1

2523—2009: Standard for Solid Fuel-fired Hydronic Heating Appliances, Water Heaters and Boilers—with revisions through March 2018
M2001.1.1, M2005.1

2703—2014: Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels—with revisions through December 2019
R902.4

7103—19: Outline of Investigation for Building-Integrated Photovoltaic Roof Covering
R902.3, R905.16.4, Table 905.16.6, R905.17.5

9540—2016: Standard for Energy Storage Systems and Equipment
R328.2, R328.6

61730-1—2017: Photovoltaic (PV) Module Safety Qualification—Part 1: Requirements for Construction
R324.3.1, R905.16.4, 905.17.5

61730-2—2017: Photovoltaic (PV) Module Safety Qualification—Part 2: Requirements for Testing
R324.3.1, R905.16.4, R905.17.5

UL/CSA/ANCE 60335-2-40—((~~2012~~)) 2019: ((~~Standard for~~)) Household and Similar Electrical Appliances ((~~,~~)) – Safety: Part 2-40: Particular Requirements for ((~~Motor-compressors~~)) Electrical Heat Pumps, Air Conditioners and Dehumidifiers
((~~M1402.1,~~)) M1403.1, M1412.1, M1413.1 ((~~, M2006.1~~))

ULC

ULC
13775 Commerce Parkway
Richmond, BC V6V 2V4

CAN/ULC S 102.2—2018: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
R302.10.1, R302.10.2

US-FTC

United States-Federal Trade Commission
600 Pennsylvania Avenue NW
Washington, DC 20580

CFR Title 16(2015): R-value Rule
N1101.10.4

APPENDICES AA through AE

Note: Appendices AA through AE are not adopted by The City of Seattle.

APPENDIX AF
RADON CONTROL METHODS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: *Appendix AF contains provisions that are intended to mitigate the transfer of radon gases from the soil into dwelling units. Radon is a radioactive gas that has been identified as a cancer-causing agent. Radon comes from the natural breakdown of uranium in soil, rock and water.*

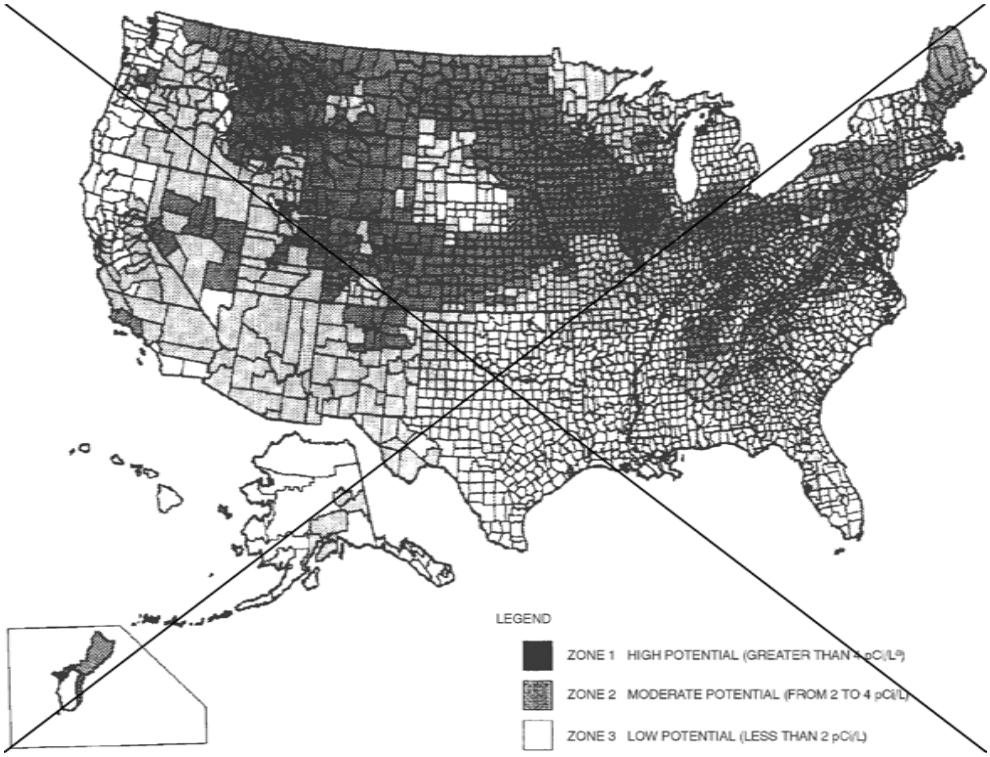
SECTION AF101
SCOPE

[W] AF101.1 General. This appendix contains requirements for new construction in *jurisdictions* where radon-resistant construction is required.

Inclusion of this appendix by *jurisdictions* shall be ((~~determined through the use of locally available data or determination of Zone 1 designation in Figure AF101.1 and Table AF101.1~~)) required in high radon potential counties as determined in Figure AF101 and as listed in Table AF101.1.

Unvented crawl spaces are not permitted in any high radon potential county. In other areas, requirements of this appendix apply to any structure constructed with unvented crawl spaces as specified in R408.3.

APPENDIX AF— RADON CONTROL METHODS



ZONE 1 HIGH POTENTIAL (GREATER THAN 4 pCi/L[a])**[Red/Darkest]**
ZONE 2 MODERATE POTENTIAL (FROM 2 TO 4 pCi/L)**[Orange/Midrange]**
ZONE 3 LOW POTENTIAL (LESS THAN 2 pCi/L)**[Yellow/Lightest]**

a. pCi/L ((~~stands~~)) standard for picocuries per liter of radon gas. ((~~The US Environmental Protection Agency (EPA)~~)) EPA recommends that all homes that measure 4 pCi/L and greater be mitigated.

The ((~~EPA~~)) United States Environmental Protection Agency and the ((~~US~~)) United States Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist building officials in deciding whether radon-resistant features are applicable in new construction.

The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon-control methods. The radon zone designation of highest priority is Zone 1. Table ((~~AF101.1~~)) 1 of this appendix lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (((~~EPA-401-R-93-021~~)) EPA-402-R-93-021 through 070) available through the State Radon Offices or from the U.S. EPA Regional Offices.

[W] FIGURE ((~~AF101.1~~)) AF101
EPA MAP OF RADON ZONES LEGEND

TABLE AF101.1—continued
HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]

VIRGINIA—continued	Brooke	**WISCONSIN**	Richland	Hot Springs
Stafford	Grant	Buffalo	Rock	Johnson
Staunton	Greenbrier	Crawford	Shawano	Laramie
Tazewell	Hampshire	Dane	St. Croix	Lincoln
Warren	Hancock	Dodge	Vernon	Natrona
Washington	Hardy	Door	Walworth	Niobrara
Waynesboro	Jefferson	Fond du Lac	Washington	Park
Winchester	Marshall	Grant	Waukesha	Sheridan
Wythe	Mercer	Green	Waupaca	Sublette
WASHINGTON	Mineral	Green Lake	Wood	Sweetwater
Clark	Monongalia	Iowa	**WYOMING**	Teton
Ferry	Monroe	Jefferson	Albany	Uinta
Okanogan	Morgan	Lafayette	Big Horn	Washakie
Pend Oreille	Ohio	Langlade	Campbell	
Skamania	Pendleton	Marathon	Carbon	
Spokane	Pocahontas	Menominee	Converse	
Stevens	Preston	Pepin	Crook	
W. VIRGINIA	Summers	Pierce	Fremont	
Berkeley	Wetzel	Portage	Goshen	

a. The EPA recommends that this county listing be supplemented with other available state and local data to further understand the radon potential of a Zone 1 area.

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or *crawl space* footing.

RADON GAS. A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower submembrane air pressure relative to *crawl space* air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM (Active). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the *conditioned space* of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

SECTION AF103
REQUIREMENTS

[W] AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary (see Figure AF103.1). These techniques are required in ((~~areas~~)) high radon potential counties where designated ((~~by the *jurisdiction*~~)) in Table AF101.1.

building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6 Passive subslab depressurization system. In *basement* or slab-on-grade buildings, the following components of a passive subslab depressurization system shall be installed during construction.

AF103.6.1 Vent pipe. A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gastight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6.2 Multiple vent pipes. In buildings where interior footings or other barriers separate the subslab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.7 Vent pipe drainage. Components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

AF103.8 Vent pipe accessibility. Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the *habitable space*.

Exception: The radon vent pipe need not be accessible in an attic space where an *approved* roof-top electrical supply is provided for future use.

AF103.9 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

AF103.10 Combination foundations. Combination *basement*/*crawl space* or slab-on-grade/*crawl space* foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

AF103.11 Building depressurization. Joints in air ducts and plenums in unconditioned spaces shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.

AF103.12 Power source. To provide for future installation of an active submembrane or subslab depressurization system, an electrical circuit terminated in an *approved* box shall be installed during construction in the attic or other anticipated location of vent pipe fans. An electrical supply shall be accessible in anticipated locations of system failure alarms.

[S] ((~~SECTION AF104~~
~~TESTING~~

~~**AF104.1 Testing.** Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:~~

1. ~~Testing shall be performed after the dwelling passes its air tightness test.~~
2. ~~Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating.~~
3. ~~Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately.~~
4. ~~Testing shall not be performed in a closet, hallway, *stairway*, laundry room, furnace room, bathroom or kitchen.~~
5. ~~Testing shall be performed with a commercially available radon test kit or testing shall be performed by an *approved* third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer's instructions.~~
6. ~~Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for not fewer than 12 hours prior to the testing.~~
7. ~~Testing shall be performed by the builder, a *registered design professional* or an *approved* third party.~~
8. ~~Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer, whichever is longer.~~

~~9. Written radon test results shall be provided by the test lab or testing party. The final written test report with results less than 4 picocuries per liter (pCi/L) shall be provided to the code official.~~

~~10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.9 and AF103.12.~~

~~11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.~~

~~**Exception:** Testing is not required where the occupied space is located above an unenclosed open space.~~))

APPENDICES AG through AP

Note: Appendices AG through AP are not adopted by The City of Seattle.

APPENDIX AQ
TINY HOUSES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: *Appendix AQ relaxes various requirements in the body of the code as they apply to houses that are 400 square feet in area or less. Attention is specifically paid to features such as compact stairs, including stair handrails and headroom, ladders, reduced ceiling heights in lofts and guard and emergency escape and rescue opening requirements at lofts.*

SECTION AQ101
GENERAL

AQ101.1 Scope. This appendix shall be applicable to *tiny houses* used as single *dwelling units*. *Tiny houses* shall comply with this code except as otherwise stated in this appendix.

SECTION AQ102
DEFINITIONS

AQ102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

[W] ((~~EGRESS ROOF ACCESS WINDOW.~~ ~~A *skylight* or roof window designed and installed to satisfy the emergency escape and rescue opening requirements of Section R310.2.~~))

[W] ((~~LANDING PLATFORM.~~ ~~A landing provided as the top step of a stairway accessing a *loft*.~~))

[W] ((~~LOFT.~~ ~~A floor level located more than 30 inches (762 mm) above the main floor, open to the main floor on one or more sides with a ceiling height of less than 6 feet 8 inches (2032 mm) and used as a living or sleeping space.~~))

[W] TINY HOUSE. A *dwelling* that is 400 square feet (37 m^2) or less in floor area excluding *lofts*.

SECTION AQ103
CEILING HEIGHT

[W] AQ103.1 Minimum ceiling height. *Habitable space* ((~~and hallways~~)) in *tiny houses* shall have a ceiling height of not less than 6 feet 8 inches (2032 mm). Bathrooms, toilet rooms and kitchens shall have a ceiling height of not less than 6 feet 4 inches (1930 mm). Obstructions including, but not limited to, beams, girders, ducts and lighting, shall not extend below these minimum ceiling heights.

Exception: Ceiling heights in *lofts* ((~~are permitted to~~)) shall be ((~~less than 6 feet 8 inches (2032 mm)~~)) in accordance with Section R326.

[W] SECTION AQ104
((~~LOFTS~~)) ENERGY CONSERVATION

((~~**AQ104.1 Minimum loft area and dimensions.** *Lofts* used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections AQ104.1.1 through AQ104.1.3.~~

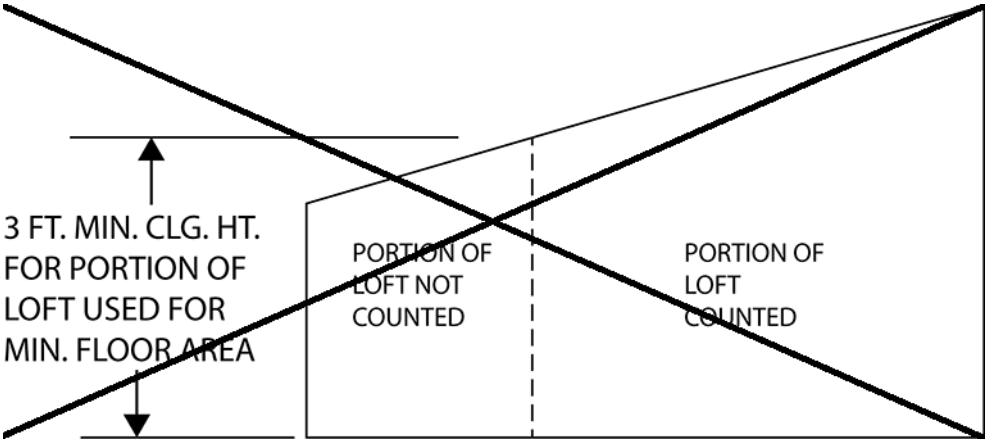
~~**AQ104.1.1 Minimum area.** *Lofts* shall have a floor area of not less than 35 square feet (3.25 m^2).~~

~~**AQ104.1.2 Minimum horizontal dimensions.** *Lofts* shall be not less than 5 feet (1524 mm) in any horizontal dimension.~~

~~**AQ104.1.3 Height effect on loft area.** Portions of a *loft* with a sloped ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft. See Figure AQ104.1.3.~~

~~**Exception:** Under gable roofs with a minimum slope of 6 units vertical in 12 units horizontal (50 percent slope), portions of a *loft* with a sloped ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the *loft*.~~

APPENDIX AQ—TINY HOUSES



~~For SI: 1 foot = 304.8 mm.~~

~~FIGURE AQ104.1.3~~
~~HEIGHT EFFECT ON LOFT AREA~~

~~AQ104.2 Loft access and egress.~~ ~~The access to and primary egress from *lofts* shall be of any type described in Sections AQ104.2.1 through AQ104.2.5. The *loft* access and egress element along its required minimum width shall meet the *loft* where its ceiling height is not less than 3 feet (914 mm).~~

~~AQ104.2.1 Stairways.~~ ~~Stairways accessing *lofts* shall comply with this code or with Sections AQ104.2.1.1 through AQ104.2.1.7.~~

~~AQ104.2.1.1 Width.~~ ~~Stairways accessing a *loft* shall not be less than 17 inches (432 mm) in clear width at or above the *handrail*. The width below the *handrail* shall be not less than 20 inches (508 mm).~~

~~AQ104.2.1.2 Headroom.~~ ~~The headroom above stairways accessing a *loft* shall be not less than 6 feet 2 inches (1880 mm), as measured vertically, from a sloped line connecting the tread, landing or landing platform *nosings* in the center of their width and vertically from the landing platform along the center of its width.~~

~~AQ104.2.1.3 Treads and risers.~~ ~~*Risers* for stairs accessing a *loft* shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:~~

1. ~~The tread depth shall be 20 inches (508 mm) minus four-thirds of the riser height.~~
2. ~~The riser height shall be 15 inches (381 mm) minus three-fourths of the tread depth.~~

~~AQ104.2.1.4 Landings.~~ ~~Intermediate landings and landings at the bottom of stairways shall comply with Section R311.7.6, except that the depth in the direction of travel shall be not less than 24 inches (610 mm).~~

~~AQ104.2.1.5 Landing platforms.~~ ~~The top tread and *riser* of stairways accessing *lofts* shall be constructed as a *landing platform* where the *loft* ceiling height is less than 6 feet 2 inches (1880 mm) where the stairway meets the *loft*. The *landing platform* shall be not less than 20 inches (508 mm) in width and in depth measured horizontally from and perpendicular to the *nosing* of the landing platform. The landing platform riser height to the loft floor shall be not less than 16 inches (406 mm) and not greater than 18 inches (457 mm).~~

~~AQ104.2.1.6 Handrails.~~ ~~*Handrails* shall comply with Section R311.7.8.~~

~~AQ104.2.1.7 Stairway guards.~~ ~~Guards at open sides of stairways, landings and landing platforms shall comply with Section R312.1.~~

~~AQ104.2.2 Ladders.~~ ~~Ladders accessing *lofts* shall comply with Sections AQ104.2.1 and AQ104.2.2.2.~~

~~AQ104.2.2.1 Size and capacity.~~ ~~Ladders accessing *lofts* shall have a rung width of not less than 12 inches (305 mm), and 10-inch (254 mm) to 14-inch (356 mm) spacing between rungs. Ladders shall be capable of supporting a 300-pound (136 kg) load on any rung. Rung spacing shall be uniform within 3/8 inch (9.5 mm).~~

~~AQ104.2.2.2 Incline.~~ ~~Ladders shall be installed at 70 to 80 degrees from horizontal.~~

~~AQ104.2.3 Alternating tread devices.~~ ~~Alternating tread devices accessing *lofts* shall comply with Sections R311.7.11.1 and R311.7.11.2. The clear width at and below the *handrails* shall be not less than 20 inches (508 mm).~~

~~AQ104.2.4 Ship's ladders.~~ ~~Ship's ladders accessing *lofts* shall comply with Sections R311.7.12.1 and R311.7.12.2. The clear width at and below *handrails* shall be not less than 20 inches (508 mm).~~

~~**AQ104.2.5 Loft guards.** *Loft* guards shall be located along the open sides of *lofts*. *Loft* guards shall be not less than 36 inches (914 mm) in height or one-half of the clear height to the ceiling, whichever is less. *Loft* guards shall comply with Section R312.1.3 and Table R301.5 for their components.~~))

[W] AQ104.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per feet of the dwelling unit enclosure area. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed after the continuous air barrier, including all penetrations, is completed and sealed.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior louvers for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ104.1.1 Whole house mechanical ventilation. Where an air leakage rate not exceeding 0.30 cfm per ft of the dwelling unit enclosure area in accordance with Section AQ106.1 is provided, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

[W] ((~~SECTION AQ105~~ ~~EMERGENCY ESCAPE AND RESCUE OPENINGS~~

~~**AQ105.1 General.** *Tiny houses* shall meet the requirements of Section R310 for emergency escape and rescue openings.~~

~~**Exception:** *Egress roof access windows* in *lofts* used as sleeping rooms shall be deemed to meet the requirements of Section R310 where installed such that the bottom of the opening is not more than 44 inches (1118 mm) above the *loft* floor, provided the egress roof access window complies with the minimum opening area requirements of Section R310.2.1.~~))

[S] ((~~SECTION AQ106~~ ~~ENERGY CONSERVATION~~

~~**AQ106.1 Air leakage testing.** The air leakage rate for *tiny houses* shall not exceed 0.30 cubic feet per minute at 50 Pascals of pressure per square foot of the *dwelling unit* enclosure area. The air leakage testing shall be in accordance with the testing methods required in Section N1102.4.1.2. The *dwelling unit* enclosure area shall be the sum of the areas of ceilings, floors and walls that separate the conditioned space of a *dwelling unit* from the exterior, its adjacent unconditioned spaces and adjacent *dwelling units*.~~

~~**AQ106.1.1 Whole-house mechanical ventilation.** Where the air leakage rate is in accordance with Section AQ106.1, the *tiny house* shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.~~

~~**AQ106.2 Alternative compliance.** *Tiny houses* shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code*, provided that the following conditions are met:~~

1. ~~The insulation and fenestration meet the requirements of Table N1102.1.2.~~
2. ~~The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.~~
3. ~~Solar, wind or other renewable energy source supplies not less than 90 percent of the energy use for the structure.~~
4. ~~Solar, wind or other renewable energy source supplies not less than 90 percent of the energy for service water heating.~~
5. ~~Permanently installed lighting is in accordance with Section N1104.~~
6. ~~Mechanical ventilation is provided in accordance with Section M1505 and operable fenestration is not used to meet ventilation requirements.~~))

APPENDICES AR and AS

Note: Appendices AR and AS are not adopted by The City of Seattle.

APPENDIX AT [RE]

SOLAR-READY PROVISIONS— DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES

[W] ((~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~))

User note:

About this appendix: *Harnessing the heat or radiation from the sun's rays is a method to reduce the energy consumption of a building. Although Appendix AT does not require solar systems to be installed for a building, it does require the space(s) for installing such systems, providing pathways for connections and requiring adequate structural capacity of roof systems to support solar systems.*

Section numbers in parenthesis are those in Appendix RB of the residential provisions of the International Energy Conservation Code®.

SECTION AT101 (RB101) SCOPE

[S] AT101.1 (RB101.1) General. ((~~These provisions shall be applicable for new construction where solar-ready provisions are required.~~)) New one- and two-family dwellings shall be provided with a *solar-ready zone* of not less than 300 square feet. Townhouses shall be provided with a *solar-ready zone* of not less than 150 square feet for each dwelling unit.

Exception: The following do not require *solar-ready zones*:

1. One- and two-family dwellings with less than 600 square feet of qualifying roof area conforming to the requirements of Section AT101.1.1.
2. Individual units within townhouse buildings that have less than 300 square feet of qualifying roof area per unit conforming to the requirements of Section AT101.1.1.
3. Buildings with permanently installed on-site renewable energy systems.

[S] AT101.1.1 General. Qualifying roof area includes all roof areas other than the following:

1. Roof areas oriented within 45 degrees of true north and having slopes greater than 2:12.
2. Roof areas shaded by existing landforms, structures or trees for more than 70 percent of daylight hours annually. Shading from future tree growth need not be considered.
3. Roof areas consisting of skylights, occupied decks, or planted areas.
4. Access or set-back areas required by this code or the applicable provisions of the *International Fire Code*.

SECTION AT102 (RB102) GENERAL DEFINITION

AT102.1 (RB102.1) General. The following term shall, for the purpose of this appendix, have the meaning shown herein.

[W] SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar ((~~thermal~~)) water-heating system.

SECTION AT103 (RB103) SOLAR-READY ZONE

[S] AT103.1 (RB103.2) General. ((~~New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m^2) of roof area oriented between 110 degrees and 270 degrees of true north, shall comply with Sections AT103.2 through AT103.10.~~)) The solar-ready zone shall comply with Sections AT103.1.1 through AT103.1.3.

((~~Exceptions:~~

1. ~~New residential buildings with a permanently installed on-site renewable energy system.~~

~~2. A building where all areas of the roof that would otherwise meet the requirements of Section AT103 are in full or partial shade for more than 70 percent of daylight hours annually.~~))

[S] ((~~AT103.2 (RB103.2) Construction document requirements for solar-ready zone.~~ ~~*Construction documents* shall indicate the solar-ready zone.~~))

[S] ((~~AT103.3~~)) AT103.1.1 (RB103.3) Solar-ready zone area. The ((~~total~~)) solar-ready zone ((~~area shall be not less than 300 square feet (27.87 m^2) exclusive of mandatory access or setback areas as required by the *International Fire Code*~~)) may be comprised of one single area or of multiple separated areas. ((~~New townhouses three stories or less in height above *grade plane* and with a total floor area less than or equal to 2,000 square feet (185.8 m^2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m^2). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m^2) exclusive of access or set-back areas as required by the *International Fire Code*.~~)) No solar-ready zone shall be less than 5 feet in any dimension nor less than 80 square feet of contiguous area.

[S] ((~~AT103.4~~)) AT103.1.2 (RB103.4) Obstructions and shadows. ((~~Solar-ready zones~~)) The *solar-ready zone* shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment. Permanently installed objects adjacent to the *solar-ready zone* shall be located so that they do not cast shadows on the *solar-ready zone* when the sun is directly east, west, or south of the *solar-ready zone* at 45 degrees above the horizon. Such objects include but are not limited to taller portions of the building, parapets, chimneys, antennas, rooftop *equipment*, trees, and roof plantings. Shading from future tree growth need not be considered.

[S] AT103.1.3 Structural support. The supporting structure of the solar-ready zone shall be designed in accordance with Section R324.4, using a minimum of 4 pounds per square foot as an assumed photovoltaic panel weight.

[S] ((~~AT103.5 (RB103.5) Shading.~~ ~~The solar-ready zone shall be set back from any existing or new, permanently affixed object on the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings.~~))

[S] ((~~AT103.6 (RB103.6) Capped roof penetration sleeve.~~ ~~A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The capped roof penetration sleeve shall be sized to accommodate the future photovoltaic system conduit, but shall have an inside diameter of not less than 1-1/4 inches (32 mm).~~))

[S] ((~~AT103.7 (RB103.7) Roof load documentation.~~ ~~The structural design loads for roof dead load and roof *live load* shall be clearly indicated on the *construction documents*.~~))

[S] ((~~AT103.8 (RB103.8) Interconnection pathway.~~ ~~*Construction documents* shall indicate pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.~~))

[S] ((~~AT103.9~~)) AT103.2 (RB103.9) Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be *labeled* "For Future Solar Electric." ((~~The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.~~))

[S] ((~~AT103.10~~)) AT103.3 (RB103.10) ((~~Construction documentation~~)) Posted certificate. A permanent certificate, indicating the boundaries and structural provisions of the solar-ready zone, ((~~and other requirements of this section,~~)) shall be posted near the electrical distribution panel, water heater or other conspicuous location. ((~~by the builder or *registered design professional*.~~))

[S] AT103.4 Construction documents. *Construction documents* shall indicate the boundaries and the assumed photovoltaic panel weight used for design in Section T103.1.3 for the *solar-ready zone*.

APPENDICES AU through AX

Note: Appendices AU through AX are not adopted by The City of Seattle.